NINTH ANNUAL FUEL CONSERVATION NUMBER

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St. Bernard's School, Church & Parish House, Bradford, Pa.

All three buildings heated by one installation of 3 No. 8-40 Novelty Carburetor Boilers, Radiation, 13,000 Sq. Ft.

Architect: North-Shelgren-Swift, 511 Crosby Street Buffalo, N. Y.

Heating Contractor: W. Hugh McQuilken, Bradford, Pa.

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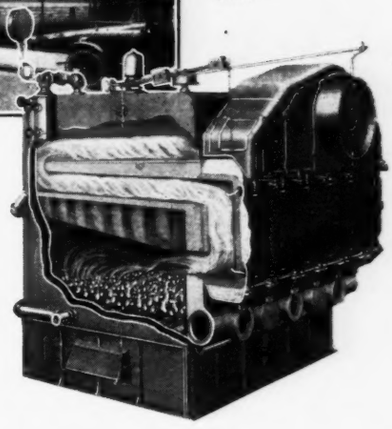

How the Architect Solved this Problem

THE architect faced a trying situation in planning the new School Building for St. Bernard's Parish, Bradford, Pa. The Church, about 150 feet away from the site of the School, was fitted with a steam heating system. The Parish House, about 300 feet away from the School Site, was equipped with Hot Water heat. In the interests of economy and convenience it was desirable to combine these two dissimilar systems with the new heating system to be installed in the School.

The architect solved his problem with utmost satisfaction, thanks to the adaptability of the Novelty Carburetor Boiler. The Hot Water pipes and radiators in the Parish House were not disturbed—the water is heated by steam from the Carburetor Boiler. The radiating system in the Church was simply disconnected from the old boiler and connected to the Novelty through underground mains. All three buildings are assured of all the heat required, even on the coldest days, yet on warm days or days when one or two of the buildings are not in use, no fuel is wasted because any of the three Novelty No. 8-40's can be shut down as desired.

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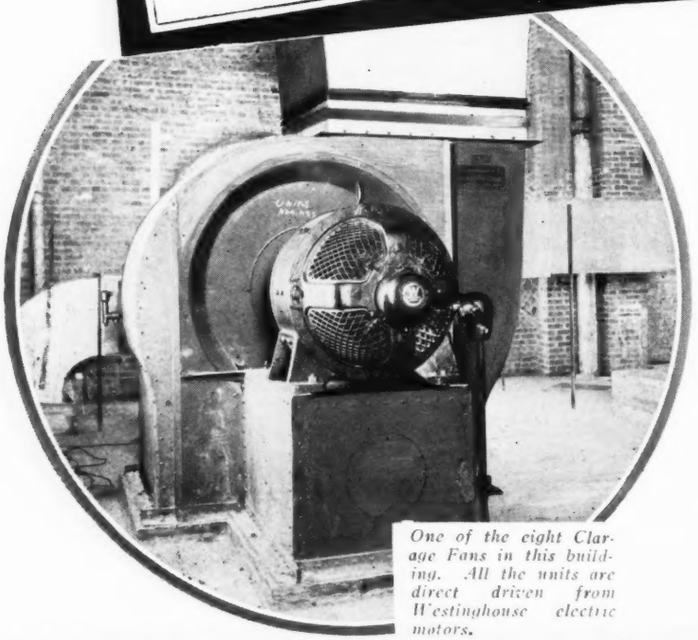

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The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress.

SEPTEMBER, 1924

Recent Accomplishments in the Field of Fuel Conservation.

A Review of the Important Developments of the Past Year in the Design of Heating and Ventilating Appliances Which Save Fuel.

By Samuel R. Lewis

1. The Development of New Forms of Indirect Heaters. These ought to be called by Professor Woodbridge's term, "convectors." It is interesting to an old-timer to observe how for many years about the only blast heater that could be obtained was a pipe coil built on a cast-iron base and usually made by a fan manufacturer. The cast-iron cored sectional convector made by a radiator foundry nearly put the pipe coil heater in the discard, and the fan manufacturers, like lions lying down with lambs, became selling agents for the radiator foundry. This situation had its diverting features to contractors who liked to buy radiators direct.

The automobile manufacturers have proved that an efficient and economical sheet-metal radiator can be built. Now we have sheet-metal convectors of brass and copper which, by their compact construction and light weight, greatly alleviate the burden on the mind of the designer, as well as that on the building structure, at the same time providing a surface of remarkable efficiency in heat transmission. There is every reason to believe that sheet-metal convectors have come to stay.

2. New Types of Air Filters. While air washers using water will doubtless continue to be used as valuable accessories for many purposes, the oil-impregnated air filters based upon the principle of the human nasal appendage have proved more efficient for their particular purpose, not only because they stop soot as well as dust, but because with them it is much more unlikely that the fan will be operated without the washer, a frequent occurrence with the pump-propelled type. A sensitive draft gauge with the filter gives visual notice of undue obstruction by dirt. No device of equal sensitiveness and visibility has been introduced to govern the cleaning of the ordinary air washer.

3. The Growth of the Unit Idea, as Applied to Ventilators and Heaters. Even the most conservative must admit that these devices have come to stay. An interesting phase of their development is evidenced by the constantly-decreasing size of the units for a given performance, gained by more efficient design and by the use of sheet-metal convectors. The production of an induction motor which does not squeal will promote greatly the facility with which unit ventilators can be applied, and will probably be the next great advance.

The production of unit heaters has been profitable to the manufacturers who have lavished money on experimentation and improvements, and when the high cost of development shall have been refunded we should be able to obtain these devices at a much lower price.

4. Heating Boilers for Burning Bituminous Coal Without Smoke. The industrial journals carry much advertising of smoke-consuming devices. It is doubtful whether perfection has been achieved. The reversed bridge wall, with auxiliary air introduction, is very popular. A high rate of combustion occurs under the bridge wall. This zone is usually some distance from the fire-door, and frequent attention is necessary to keep the grate covered and to remove clinkers.

We find this type of furnace much used in cast-iron boilers which have the sections at right angles to the direction of stoking. These are end-fired boilers.

There are several boilers especially designed for anthracite coal which have the sections parallel to the direction of stoking. These are side-fired boilers. It appears that a super side-fired boiler might be made having its inverted bridge wall at one or both sides, in which the grate could be covered and the clinkers removed with much greater ease.

Many side-fired boilers, despite their often superfluous number of fire-doors and low ratio of heating surface, are efficient and popular, due, we venture

to state, to the much improved interior circulation of the water.

5. Ash-Door Draft Dampers. There is no reason why the air for combustion should enter through the ash-door, although this is a hoary precedent. A favorable indication of independence and study is the growing tendency to put the air-supply door at some point where the delicate adjustment of the damper regulator will be less involved.

We see more and more the use of a check damper which admits air to the breeching, cooling it, and promoting longevity for all parts concerned, supplanting the butterfly damper inserted in the breeching, with its inevitable deflection of high-speed hot gases against unprotected surfaces and its short life.

6. The Use of the Orifice. The growing advocacy of steam heating plants which use restricted inlets or orifices to the radiators is noticeable. The full benefit of vapor or vacuum heating is not gained unless we put the vacuum on the radiator. There are thousands of installations, especially in large buildings having power plants, in which there is never a vacuum on the radiators unless the radiator supply valves should be closed. Thermostatic return traps will prevent much of anything but water and air from entering the return mains. From 2 lbs. to 4 lbs. steam pressure usually is maintained on large office buildings, hotels, etc., and this goes through the radiators, only water and entrained air being permitted to pass to the return.

We are approaching, the writer believes, again largely through the initiative of Professor Woodbridge, the use of greater vacuum pressures, radiators open to the returns, and orifices on the supply ends so adjusted as to permit a measure of temperature regulation by variation in vacuum intensity.

7. Improved Building Construction. More attention constantly is being paid to the quality of building construction. The manufacturers of insulation have commenced to educate us all in the importance not only of keeping the heat in the pipe, but also of keeping it in the buildings. A frame house with plenty of dry boards is fairly easy to keep warm. A masonry house, with metal sash and no air spaces, is far from easy to keep warm.

We have not exhausted the possibilities as to locating the line of demarcation at which money should no longer be invested in the heating plant, but rather in better building construction. An encouraging observation is the increase in the advertising in architectural and engineering journals of building insulation, steel sash and improved roofing materials.

A HEATING SYSTEM THAT WASTES COAL

An illustration of the contrast between the best present practice, which keeps a sharp eye on the fuel costs, and the former practice, in which the cost of operation was a secondary consideration, is furnished in the equipment for an exceedingly large one-story manufacturing plant having a high saw-tooth roof and designed for 24-hour operation, producing a product which requires the sedentary labor of many men and women. It has a large number of blast heating units suspended in the roof trusses, with elaborate metal distributing ducts and hundreds of drop risers discharging warm air towards the floor at about 20-ft. intervals from about 8 ft. above the floor.

The plant as designed will heat, since it is large enough, and the roof is of gypsum, while the glass in the skylights is double. However:

(a) The blast heaters are pipe coils, 36 rows deep, 2⅜-in. on centers, with corresponding high resistance, resulting in excessive motion power. At least eight rows of these heaters are so ineffective, due to the air having been well heated before it reaches them, that far better results for heating would have been attained if they had been omitted, handling more air at the same fan speed and increasing the width and height, using the same total surface in a shallower heater.

(b) There is an elaborate system of masonry tunnels under the floor, with unsanitary floor registers. The tunnels are used as exhaust ducts and also for carrying steam and return pipes for thousands of feet. The money invested in metal overhead would have sufficed twice over for the slight elaboration of the masonry tunnels necessary to permit them to serve as supply ducts.

With the elaborate distribution of warm air provided with either the down-feed or the up-feed system, no such extensive distribution of the ventilation openings would have been necessary. The heat inevitably radiated from the steam and return pipes would have been saved with the pipes in the supply ducts and not wasted in vent ducts already provided with mechanical exhaust. The shadows and the dust shelves caused by the overhead ducts would have been eliminated. The factory would have presented a much cleaner appearance. The heat from the underground supply ducts would have warmed the floor beneficially, rather than, with overhead ducts, warming the high roof wastefully.

In summer the buried masonry ducts would discharge the air for cooling near the floor, permitting it to pile up there, forcing the heated air to the top and out. As it is, the overhead uninsulated metal ducts, close to the hot roof, exposed to direct sun glare, must inevitably heat the fresh air, to say nothing of the added resistance due to forcing heated air measurable distances downward.

MECHANICAL OPERATION NECESSARY

This factory cannot be heated without mechanical apparatus to force the warm air downward through the ducts, since the convectors are massed overhead. On the other hand, if the tunnels had been used for supply, they could serve for enclosing distributed convectors which would operate by gravity and which would keep the building comfortable for considerable periods without operating the fans.

(c) Each of the many duct systems in this great

(*Continued on page* 55)

Insulation and Heating Possibilities in Buildings

With Figures on Heat Losses and Sizes and Costs of Heating Plants for Dwelling of Eighteen Types of Construction

By James Govan

Architect and Inspector of Hospitals for the Ontario Government.

(*Abstracted from a paper read before the Toronto Branch, The Engineering Institute of Canada, and published in The Engineering Journal of the Institute*).

NOTWITHSTANDING the scientific investigations which have been going on at the University of Toronto regarding heat losses since 1912, and the other research work which has been done at the Bureau of Standards, Washington, the Research Laboratory, Pittsburgh, and at many other universities on this continent and in Europe, the results of which have been published in recent years, there has been practically no attention given to the possibility of fuel saving by the proper application of the insulation data thus made available.

If one must attempt an explanation of the meagre results so far in the application to actual construction of the data provided by the numerous bands of experimenters and investigators in the laboratories all over this continent, perhaps it may be found in the difficulty architects and builders experience in trying to translate into capital and maintenance dollars and cents for their clients the information so scientifically provided in terms of B.T.U. losses.

As a rule the architect brings in the engineer to calculate the heating requirements after he, (the architect), has decided on the materials to be used in the wall and roof construction, the type of windows, the heights of ceilings, the number of windows on the north side as compared with the south side of the building and even the number of coats of paint to be used on the inside of the walls. Yet all of these items have a very decided effect on the B.T.U. loss, therefore on the first cost of the heating plant and still more on the annual fuel bill.

COST OF INSULATION

Without sacrificing architectural or aesthetic considerations one iota, it is possible for an engineer who knows insulation data to so advise his clients, if he is given the opportunity at the right stage of the proceedings, that the total cost of his consulting services and of effective insulation will be more than met out of the reduced cost of the heating plant and its first year's operation.

But how many engineers or architects have at hand the necessary information to enable them to figure scientifically the difference in B.T.U. loss per heating season that will result from the use of different materials in the construction of even a small building?

Apart altogether from the decreased fuel consumption in winter, insulation will more than justify its cost by improved summer conditions it will produce in our buildings.

Just how many million cubic feet of building in this country could be converted into excellent usable space, warm in winter and cool in summer, and what reduction could we make in our fire hazard by the use of adequate fireproof insulation of roof spaces, still unoccupied in spite of the rising prices of materials and labor which go into their construction?

All the arguments for and against our commonly-used building methods, such as frame construction, brick veneer, solid brick, hollow tile and stucco, prepared roofings, shingle roofs, etc., when we get down to the question of heat losses through them, do not get us very far in the reduction of our coal bills. Nor does it help us very much to read in the advertisements of many insulating materials that they are as efficient as cork per 1 in. thick when we discover that they are not generally made or sold 1 in. thick. In many cases they are not any more than ½ in. thick and in some they are as thin as ¼ in.

PUTTING DATA ON BUILDING MATERIALS IN USABLE FORM

The following table was given at the annual meeting of the American Society of Heating and Ventilating Engineers in New York in January, 1924, by Messrs. Norris, Germond and Tuttle of the C. F. Burgess Laboratories, Madison, Wis., to illustrate their paper "An Improved Method of Determining the Heat Transfer Through Wall, Floor and Roof Section."

Description	B. T. U. per hour per sq. ft. per degree F.
Standard wall (K)	0.267
5½ in. drop siding (cedar) tapered 5/16 in. thick 3⅝ in. exposed Sheathing paper—Neponset building paper 90/M Hemlock sheathing (ship lap) 7 x 13/16 in. Douglas fir studding 2 x 4 in. (1.5 x 3.5 in. actual) on 16 in. centers Hemlock lath 7/16 x 1 3/8 in. spaced ¼ in. Gypsum plaster (well dried) thickness of lath plus plaster 9/16 in.	-
Same construction as standard wall except that the lath is replaced by Insulite, the plaster being applied directly to the Insulite.	0.207
Standard wall with John's Manville Acme Hairfelt fastened between studding	0.200
Standard wall with ½ in. Flaxlinum fastened between studding with cleats	0.192
Standard wall with Cabots Quilt (double ply) fastened between studding with cleats.	0.190
Standard wall with Balsam wool fastened between studding with cleats	0.179

Information of this kind is much more useful to the prospective builder than comparison of the thermal conductivities of a lot of materials which nobody buys as described in the tables.

Here at least are data which will enable an engineer to estimate what return his client may expect for every $100.00 he spends on such forms of insulation. He can also decide by calculation or experiment whether the saving shown in the table for Balsam wool as compared with Insulite, which is also a wood-fibre product, but which is compressed so that it forms a substitute for lath, will warrant its use, when the extra cost of the lath used with the Balsam wool is taken into consideration.

For two winters a building designed in my office and built for the Ontario government has been heated by less than half of the boiler horse power which would have been necessary had ordinary construction methods been followed.

A residence just nearing completion proved to be so effectively insulated that, with only some temporary sash in place of the permanent sash and only about half the radiators connected to allow plastering to proceed, the temperature all this winter has been so comfortable that we have decided not to connect all the radiators shown on our drawings. This result has been obtained although we had allowed what we considered would be a reasonable reduction in the total square feet of radiation because of the special attention we had given to the insulation of walls and roof.

These results in this case were obtained by using 2 in. of Insulex on the walls between strapping before lath was applied and 1 in. of Lith between the rafters, protected by waterproof paper on the underside. Our experience in this case convinces me that I would have been justified economically in putting even more than 1 in. of insulation on the roof.

SPECIAL VALUE OF ROOF INSULATION

The effectiveness of preventing roof losses which we found at the job referred to, has been confirmed by a public utility corporation in one of the large American cities. They found that 2 in. of effective insulation on the ceilings of some trial houses reduced the gas bills by 37%. These houses were heated by gas heaters so it was possible to get an exact meter record of the saving; and it is interesting to note that they have decided they will not install a gas heater in future in any house which has not been insulated.

This result may be contrasted with another only recently brought to my attention. A house was protected with 4 in. of mineral wool insulation on the walls only and but a very small part of the roof was insulated. While considerable saving in fuel resulted from the good insulation on the walls, the disadvantages of neglecting the more important part, the roof, are quite apparent, when comparisons are made with jobs where the roof has received the most attention.

RESULTS OF TESTS AND STUDIES AT THE ARMOUR INSTITUTE OF TECHNOLOGY

One of the best presentations of the whole case I have ever come across is by Professor J. C. Peebles of the Armour Institute of Technology. (Mr. Govan then quotes from Mr. Peebles's report).

"In the following pages I submit a report covering estimates of the cost to heat a dwelling house of the bungalow type. Several types of wall and ceiling construction are considered, both with and without the use of special insulating material. In the case of the insulated house, the material used is Insulex, 2 in. thick in the walls and 3 in. in the ceiling. Estimates have also been made for 3 in. Insulex in walls and 4 in. in ceiling. The bungalow considered is 32 ft. long by 26 ft. wide, with a ceiling 10 ft. high. The wall surface is 930 sq. ft., glass surface 230 sq. ft., and ceiling surface 832 sq. ft.

"In making estimates of this kind it is first necessary to decide upon the temperature which will be encountered, particularly the mean outdoor temperature during the heating season. In Table 1 an entire set of assumed conditions is given, the mean outdoor temperature of 30° F. being taken from records of the United States Weather Bureau at Chicago.

TABLE 1.—CONDITIONS ASSUMED IN HEATING PROBLEM

Duration of heating season, days	200
Mean outdoor temp. during heating season, deg. F	33
Daytime indoor temp. during heating season, deg. F	70
Nighttime indoor temp. during heating season, deg. F.	55
Mean attic temp. during heating season, deg. F	40
Minimum outdoor temp. during heating season, deg. F.	10
Minimum attic temp. during heating season, deg. F	10
Complete air changes per hour due to ventilation	1

FUELS CONSIDERED

"Anthracite coal, costing $18.00 per ton, giving 12,500 B.T.U. per pound, and burned with an over-all efficiency of 60%.

"Pocahontas coal, costing $12.50 per ton, giving 14,500 B.T.U. per pound and burned with an over-all efficiency of 60%.

"Coke, costing $15.00 per ton, giving 13,000 B.T.U. per pound, and burned with an over-all efficiency of 60%.

"Fuel-oil, costing eight cents per gallon, 26 Baumé gravity, giving 19,400 B.T.U. per pound, and burned with an over-all efficiency of 70%.

"Gas, costing $1.00 per 1000 cu. ft., giving 500 B.T.U. per cubic foot, and burned with an over-all efficiency of 75%.

"Gas, same as above, burned with an over-all efficiency of 100%.

"Electricity, costing three cents per kilowatt-hour, and used with an efficiency of 100%.

"From the above data on fuels considered, the following table is worked out, showing the number of B.T.U., actually delivered to the apartments to be heated, for $1.00 spent for fuel.

TABLE 2.—USEFUL B.T.U. FROM VARIOUS FUELS

Fuel	Useful B.T.U. for $1.00
Anthracite coal	833,000
Pocahontas coal	1,400,000
Coke	1,040,000
Fuel oil	1,260,000
Gas, 75% efficiency	375,000
Electricity	113,700
Gas, 100% efficiency	500,000

Building Considered

Bungalow, 26 ft. x 32 ft. x 10 ft. Ceiling, set in the approximate center of a 50-ft. lot, so that the building is exposed on all four sides.

Types of Construction Considered

1. Ordinary frame construction, consisting of 2-in. x 4-in. wood studs, with wood sheathing, building paper and drop siding. On the inside, wood lath and lime plaster. Ceiling construction, wood lath and lime plaster on lower side of ceiling joists; no attic flooring. Single windows.

2. Same as No. 1, but with addition of 2 in. of Insulex in the walls between the studs, and 3 in. of Insulex in the ceiling between joists.

3. Same as No. 1, but with the addition of 3 in. of Insulex in the walls, and 4 in. in the ceiling; also double windows.

4. 8-in. brick wall, furring, wood lath and lime plaster. Ceiling construction same as No. 1; single windows.

5. Same as No. 4, but with addition of 2 in. of Insulex in walls and 3 in. in ceiling. Single windows. (Furring thick enough to accommodate 2 in. of Insulex in walls must be used).

6. Same as No. 4, but with addition of 3 in. of Insulex in walls and 4 in. in ceiling. Double windows. (Furring thick enought to accomodate 3 in. of Insulex in walls must be used).

7. 12-in. brick wall, furring, wood lath and lime plaster. Ceiling construction same as No. 1. Single windows.

8. Same as No. 7, but with addition of 2 in. of Insulex in walls and 3 in. in ceiling. Single windows.

9. Same as No. 7, but with addition of 3 in. of Insulex in walls and 4 in. in ceiling. Double windows.

10. 8-in. hollow clay tile, with 1⅛-in. of stucco on outside. Furring, wood lath and lime plaster. Single windows. Ceiling construction same as No. 1.

11. Same as No. 10, but with addition of 2 in. of Insulex in walls and 3 in. in ceiling. Single windows.

12. Same as No. 10, but with addition of 3 in. of Insulex in walls, and 4 in. in ceiling. Double windows.

13. Stucco, 1⅛-in. thick, over wood lath on 2-in. x 4-in. studs. On inside, wood lath and lime plaster. Ceiling construction same as No. 1, single windows.

14. Same as No. 13, but with addition of 2 in. of Insulex in walls and 3 in. in ceiling. Single windows.

15. Same as No. 13, but with addition of 3 in. of Insulex in walls and 4 in. in ceiling. Double windows.

16. 8-in. cement block, furring, wood lath and lime plaster. Ceiling construction same as No. 1. Single windows.

17. Same as No. 16, but with addition of 2 in. of Insulex in walls and 3 in. in ceiling. Single windows.

18. Same as No. 16, but with addition of 3 in. of Insulex in walls and 4 in. in ceiling. Double windows.

TABLE 3.—COEFFICIENTS OF HEAT TRANSMISSION

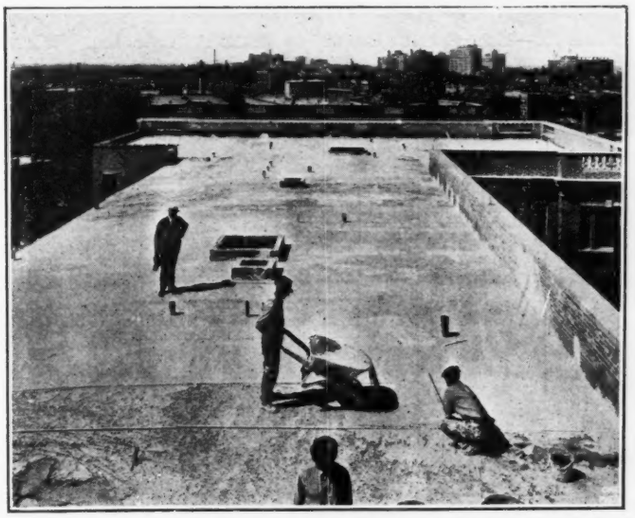
"Table of coefficients of heat transmission, expressed in B.T.U., transmitted per hour per square foot of surface per degree F. difference in temperature between the inside and outside air.

Wall Number	Transmission Coefficient
1	0.266
2	0.130
3	0.102
4	0.240
5	0.123
6	0.098
7	0.193
8	0.109
9	0.089
10	0.190
11	0.108
12	0.0887
13	0.433
14	0.158
15	0.120
16	0.308
17	0.138
18	0.108

Ceiling Number	Transmission Coefficient
1	0.600
2	0.140
3	0.104
Single window	1.00
Double window	0.50

"Making use of the assumed temperature conditions, as outlined in Table 1, and the estimated coefficients of heat transmission, given in Table 3, and allowing for one complete air change per hour due to ventilation, the probable heat loss for the heating season is readily estimated. Making use of Table 2, this annual heat loss is easily expressed in dollars for each type of fuel to be considered. The annual heat loss from each type of construction, together with the cost to supply that amount of heat with each of the fuels considered, is given in Table 4 below.

"If a steam or hot water plant is fired with fuel-oil or gas, instead of coal or coke, a certain



Insulating Hotel Roof By Pouring 2 In. of Insulex Over Roof Deck.

TABLE 4.—ANNUAL HEAT LOSS AND COST OF SAME FOR VARIOUS TYPES OF CONSTRUCTION

House Number	Annual Heat Loss Million B.t.u.	Fuel costs — Dollars						Electricity
		Anthur.	Pocah.	Coke	Oil	Gas 75%	Gas 100%	
1	168.07	201	120	162	133	450	336	1,480
2	91.47	109 50	65.20	87 70	72 50	244	183	803
3	66.16	79.75	47 25	63.50	52 50	177	133	580
4	164.48	198.50	117.50	158.20	130 50	438	328	1,448
5	90.56	108.50	64.60	87.00	71 85	241	182	800
6	65.66	79.20	46.90	63 10	52 20	176	132	577
7	158.58	191.25	113.30	152.50	125 90	422	317	1,395
8	88.56	107.50	63.25	85 10	70 20	236	178	780
9	64.33	77.70	46.00	61.80	51 00	173	130	566
10	158.18	191.00	113.00	152.00	125.60	421	316	1,390
11	88.36	106.30	63.10	84.75	70.15	235	177	776
12	64.14	77.25	45.80	61.65	50.85	171	128	564
13	192.68	232.00	137.50	185.00	152.90	513	385	1,695
14	95.46	115.00	68.15	91.75	75.75	255	191	840
15	68.70	82.80	49.10	66.10	53.75	185	151	605
16	174.88	210.60	124.70	168.00	138.60	467	350	1,310
17	92.60	11.50	66.15	89.00	73.50	247	185	815
18	66 198	80 75	47.80	64.40	53.15	179	134	589

addition must be made to the costs shown in Table 5. Several makes of oil burning equipment for house heating are on the market, differing considerably in design and cost. A satisfactory system, automatic in its operation, is rather expensive and this fact appears to be one of the chief reasons why home owners are slow in adopting oil heat.

"It will be noted that this report deals in general with three classes of construction: (a) uninsulated; (b) medium insulation; and (c) heavy insulation. In all Class A houses, an allowance of $500.00 has been made to cover the cost of oil-burning equipment. An allowance of $450.00 is made for Class B houses, and $400.00 for Class C houses. These allowances are to be added to the plant costs shown in Table 5, whenever oil is to be used in a steam or hot water plant.

"Unless natural gas is available, steam or water heating plants are rarely fired with gas. Such a system should be thermostatically controlled and provided with pilot light so that the operation will be practically automatic. To cover the cost of such a system, $400.00 has been allowed for Class A houses, $350.00 for Class B, and $300.00 for Class C houses.

TABLE 5.—SIZES AND COSTS OF STEAM AND HOT WATER PLANTS

House Number	Max. Heat Loss Per Hr. B.t.u.	Radiation Required Sq. ft.		Cost of Heating Plant, Installed Dollars		Saving in First Cost Dollars	
		Steam	Hot Water	Steam	Hot Water	Steam	Hot Water
1	84,730	339	471	424	706	...	...
2	50,660	203	281	254	422	170	284
3	36,453	146	203	183	305	241	401
4	82,586	330	459	413	689	...	...
5	50,095	200	278	250	417	163	272
6	36,074	144	200	180	300	259	389
7	78,725	315	438	394	657	...	...
8	48,962	196	275	245	412	149	245
9	35,397	142	197	178	296	216	361
10	78,504	314	436	393	655	...	...
11	48,874	195	272	244	408	149	247
12	35,375	142	196	178	294	215	361
13	98,370	394	547	493	821	...	...
14	52,955	212	294	265	442	228	379
15	37,933	152	211	190	317	303	504
16	88,140	353	490	442	735	...	...
17	51,316	205	285	256	428	186	307
18	37,025	148	206	185	309	257	426

"In order to show the method used in making the foregoing calculations consider House No. 2, which is ordinary wood construction with 2 in. of Insulex in the walls and 3 in. in the ceiling. The data upon which the heat loss is estimated are as follows:

Heating season days	200
Mean outdoor temperature, deg. F	33
Mean daytime indoor temp. (16 hrs. per day) deg. F.	70
Mean night time indoor temp. (8 hrs. per day) deg. F.	55
Mean attic temperature, deg. F	40
Coefficient heat transmission for walls	0.13
Coefficient heat transmission for ceiling	0.14
Coefficient heat transmission for windows	1.00
Air changes per hour due to ventilation	1
Density of air, pounds per cu. ft.	0.077
Specific heat of air, B.T.U. per pound	0.25
Day time heat loss through solid walls $930 \times 0.13 \times 37 \times 16 \times 200$	= 14,300,000
Day time heat loss through glass $230 \times 1.00 \times 37 \times 16 \times 200$	= 27,200,000
Night time heat loss through solid walls $930 \times 0.13 \times 23 \times 16 \times 200$	= 4,260,000
Night time heat loss through glass $230 \times 1.00 \times 22 \times 8 \times 200$	= 8,100,000
Day time heat loss through ceiling $832 \times 0.14 \times 30 \times 16 \times 200$	= 11,180,000
Night time heat loss through ceiling $832 \times 0.14 \times 15 \times 8 \times 200$	= 2,800,000
Day time heat loss due to ventilation $32 \times 26 \times 0.077 \times 0.25 \times 10 \times 37 \times 16 \times 200$	= 18,200,000
Night time heat loss due to ventilation $32 \times 26 \times 10 \times 0.077 \times 0.25 \times 22 \times 8 \times 200$	= 5,400,000
Total heat loss for heating season, B.T.U.	91,440.000

"In the same manner as above the maximum heat loss from the building is calculated by substituting the maximum temperature difference for the mean and using the hour instead of the season as the unit of time. To the maximum hourly heat loss through the walls calculated in this way 10% is added to cover extra losses from the exposed sides of the building. The calculations are as follows:

Maximum hourly heat loss through walls	$93 \times 0.13 \times 80$	= 9,670
Maximum hourly heat loss through windows	$230 \times 1.00 \times 80$	= 18,400
Maximum hourly heat loss through ceiling	$832 \times 0.14 \times 60$	= 6,980
Add 10% of above losses for exposure		= 2,800
Maximum hourly heat loss due to ventilation	$32 \times 26 \times 10 \times .077 \times .25 \times 80$	= 12,810
Total maximum hourly heat loss		50,660

$$\text{Steam radiation required} = \frac{50{,}660}{250} = 203 \text{ sq. ft.}$$

INFILTRATION OF AIR THROUGH WALLS AND OPENINGS

"No study of insulation and heating possibilities would be complete without some reference to the problem of air infiltration through walls and openings in buildings. The benefits of even the best insulation will be nullified if we pay no attention to the heat losses due to poor construction and badly-fitting windows and doors.

"The gains in efficiency due to sealing up wall construction and closing the cracks around window frames and window sashes in various ways were graphically shown by Messrs. Houghton and Schrader in their paper, 'Air Leakage Through the Openings in Buildings,' (Journal A. S. H. & V. E., Feb. 1924).

Economy Methods Which Have Made Central Station Heating Practicable

How Regulation of Steam Requirements Has Been Secured by Closing Off at Night and by Adopting Automatic Pressure and Temperature Control During the Day

By H. A. Woodworth

ONE OF the things which have made central station heating practical, as well as popular, with the customer, is: Economical regulation of steam requirements.

To accomplish this it has taken many years of experimental work, the net result of which has proven that steam is saved by closing off at the proper time at night and automatic pressure and temperature control during the day.

The steam heating companies have highly-trained steam experts who save the customer the difference between steam actually *required* and the amount he has been accustomed *to take*. The saving of this waste has been accomplished by automatic temperature control. A review of the first applications leading down to the present-day methods follows:

CENTRAL HEAT CONTROL

About twenty-five years ago a scheme was devised to transfer the heat of exhaust steam into water and to circulate the water underground for heating purposes.

In the absence of measuring devices the basis of charge was that of the amount of radiation required, and this at once made it necessary to control the flow of heat, otherwise not even a guess could be made as between the heat required and actually delivered.

The system of regulation or control first adopted was what is known as the air control, as manufactured by the Powers Regulator Company of Chicago. This control called for an air-line paralleling the heat mains, the air pressure being approximately 15 lbs. and the supply furnished by means of an air pump at the power house.

Good results were obtained and some plants operating twenty years or more are still controlling in this manner.

Underground conditions, varying with localities, made the life of air lines short or long, and in many cases air control had to be abandoned because of the heavy expense of renewing the air lines. The necessity, however, of continuing a control of some kind led to the development of what might be called the "master control," except that in the "master control" as here described, the control of pressures and temperatures are combined in one valve.

Fig. 1 shows a type of pressure and temperature, or "master control," valve. Its operation is simply that the lower diaphragm controls the pressure and the motor, by means of a thermostat, controls the temperature. There is no mechanical connection inside of the valve to cause interference of operation, the upper valve stem simply backs-off by means of motor drive, and the pressure control resumes its function as a reducing valve if the valve is used on steam heating, and as a differential valve it used on forced circulation water heating.

Observations have been made from time to time, both on controls for steam heating and for water heating. These observations extend over a period of more than twenty years, and several have been made by committees and published in the proceedings of the National District Heating Association. In all cases, where no control has been attempted, a saving has been shown which is quite out of proportion to the money invested.

The foregoing is a brief history of central heat control appliances and the development of them to their present form and efficiency. It may be said that the road has not always been easy, as it has been difficult at times to convince the central station manager that control is essential to the success of the undertaking; in fact, it might further be said that the central station manager of two decades ago was much more an electric light manager than a central heating manager, which too often resulted in the heating department getting only his "spare" time.

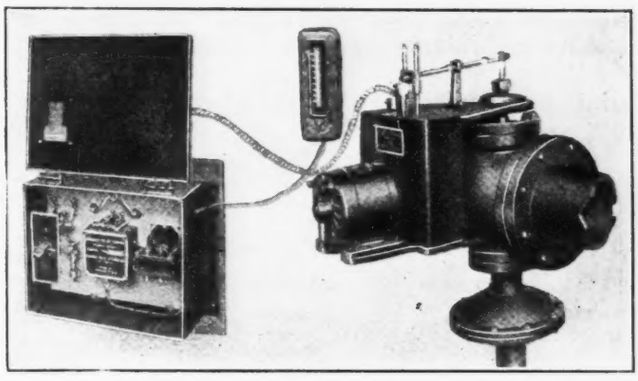


Fig. 1—Pressure or Temperature, or "Master Control" Valve

More recent examination into the possibilities of central heating, due, in a measure, to the general advance in the cost of heating, has materially changed matters, making "control" an essential part of every heating equipment; this is true whether it be steam or hot water or whether service be measured or unmeasured.

HOW TO MAINTAIN RATES AND REDUCE HEAT BILLS

A brief analysis of how rates can be maintained and at the same time the heat bills be materially reduced may be of interest. We will say that the average central heat customer is primarily interested in his annual heat bill, and that with the aid

of a variety of agencies he usually succeeds in getting his heat near the cost of production and often below. This does not always mean that the customer is paying too much per thousand pounds or per square foot of radiation required, but it does nearly always mean that he pays too much for the heat he needs. The difference between what the customer actually needs for his comfort and what he takes from the company, that is, the *waste*, is the "bone of contention."

The central heat manager who studies the situation carefully can go to his customer, who is actually paying for too much heat, and who may for this reason be a potential rate case creator and say to him: "You are taking, by measurement, all the heat billed and at the established rates, but the trouble is, you are taking more than you need. Instead of closing off the heat, you throw the windows open and that makes the radiators work still harder, and makes the meter run still faster. I also notice that you do not try to slow down your heat at night."

This might indicate at first glance that Mr. Manager is a poor salesman but this is not so. By recommending to his customer that he employ some means of stopping the flow of heat when he doesn't want and doesn't need it, he is simply saving this excess heat, for which he usually gets the lowest rate, to sell to another customer is willing to pay the higher rate. The first customer, if he follows the advise of the manager, is usually converted into a satisfied customer, equitable rates have been maintained, and the great law of conservation has been respected.

Control of pressures or of temperatures, or of both, at one point or with one thermostat, does not mean that an office building or a department store may be kept at an even temperature throughout, but it does mean that the one who throws up his windows may have occasion to lower them again, incidentally stopping that criminal waste. It means that the entire system (radiation and piping) is shut off when no further heat is required, that is, the meter stops before the waste begins.

It means that "master control" or sectional control does not interfere with individual control of rooms or radiators, as it stops the supply of heat only when no heat is required in the building. It means that radiation set to maintain 70° inside at zero outside temperature, can and should be cut off 65% of the time when the outside temperature is 40°, the average temperature of our heating season. Finally, it means that the central station and the customer will benefit equally by controlling the heat down to actual requirements.

RESULTS OF A SERIES OF AUTOMATIC TEMPERATURE-CONTROL TESTS

To reach the most practical conclusions as to the economy gained by automatic temperature-pressure control, the writer ran a series of tests and the results showed savings ranging from 35% to 60%. One of the most conservative of these tests was conducted over a period of one heating season. The installation contained 3110 sq. ft. of radiation. A 4-in. low-pressure temperature-control device was installed in the service line. There was but one

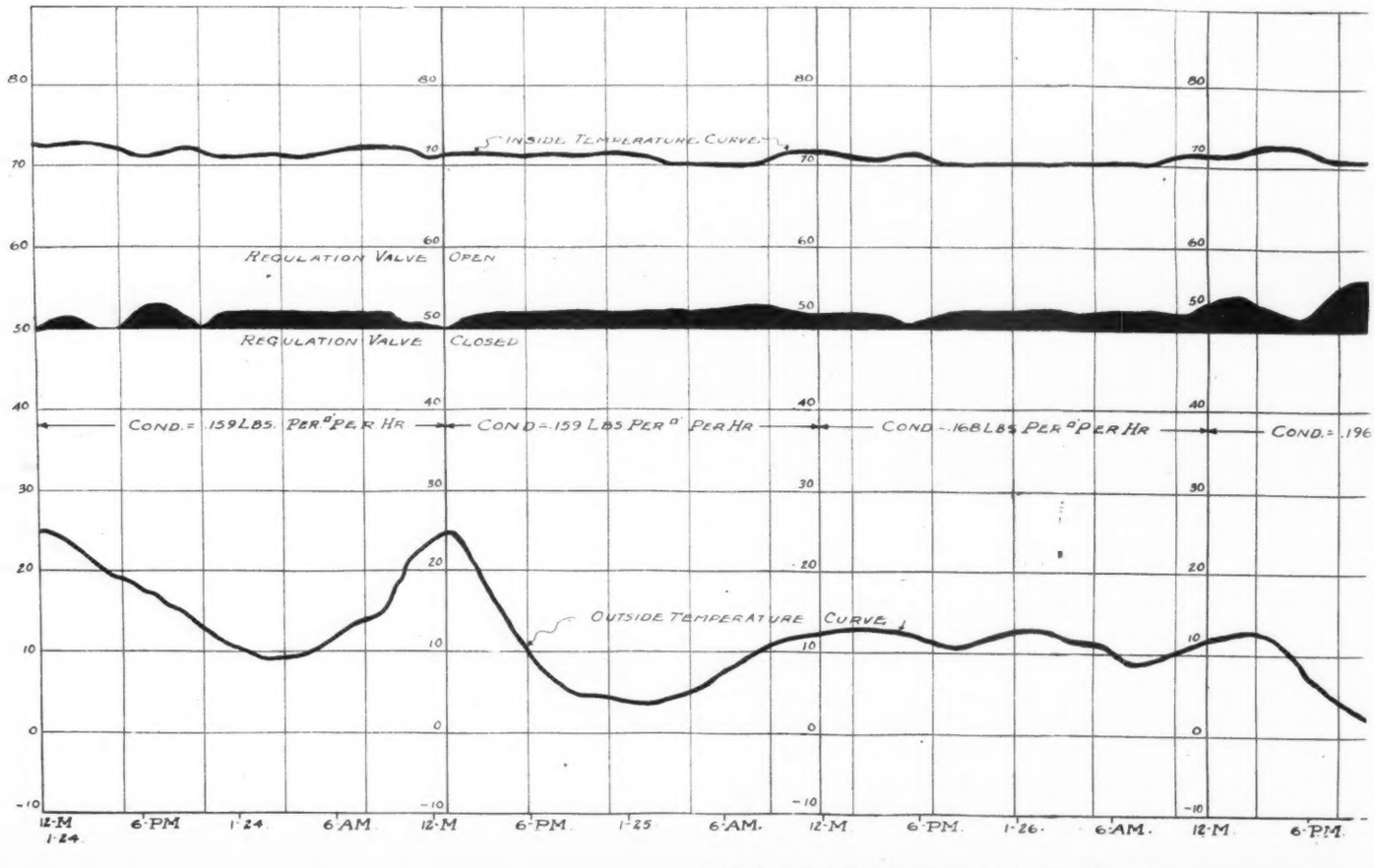


Fig. 2—Results of Automatic Temperature-Pressure Con-

thermostat located at a neutral point in the building and the one 4-in. valve controlled the entire supply of steam to customer's building. Careful readings were made from which were plotted curves for inside temperature, outside temperature and position of regulator valve in the steam supply. The condensation was metered and hourly readings obtained for each day.

The chart illustrated in Fig. 2 shows one of many similar tests which gave the same average results. The average for all tests showed a saving of 45% of steam for the heating season and this particular test is, therefore, taken as typical of actual results over a longer period.

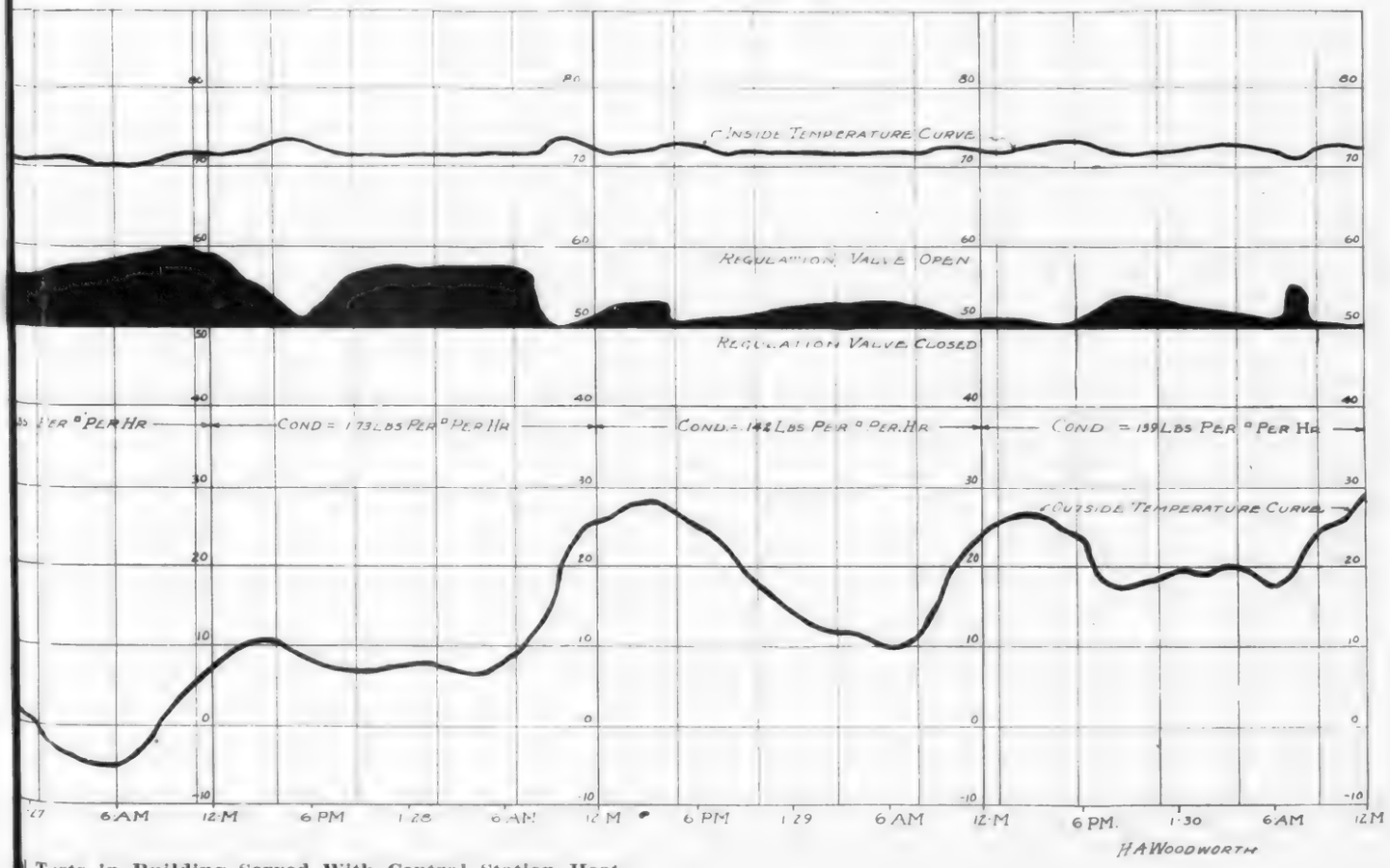
By following the inside temperature curve, it will be noted that the temperature at no point fell below 70° F. and advanced to 73° or 74° only for short infrequent periods when there was a sudden rise in the outside temperature. The inside temperature for the most of the period remained almost constant at between 70° and 72°, notwithstanding the wide variation in outside temperature as shown in the lower curve, which was constantly changing, falling as low as 5° below zero on one day and rising above 20° frequently.

This gave comfort and healthful living conditions for tenants. Without regulation, the rooms would have been over-heated as the control valve would have been open wide at all times, thus supplying much more steam than required to maintain the desired temperature.

The economy is well illustrated in the curve showing the position of the regulator valve. The distance between the horizontal lines marked "50" and "60" represents a full opening of the valve. The darkened portions of the space between these lines show relative position of the valve during the test. There is a very close relation between the position of the valve and the outside temperature. As the temperature falls, the thermostat opens the valve; as the temperature advances, the thermostat closes the valve. Only once was the valve opened wide, between 6:00 A. M. and noon of the fourth day when the outside temperature fell to 5° below zero. Notice that the inside temperature remained practically constant during that time and that as soon as it reached about 70° or 71° the thermostat began to close it as the outside temperature advanced.

"Master control" is particularly well adapted for use on central station heating as it requires no attention at any time, being electrically controlled. Many of the central heating companies throughout the country are using this type of control and recommending it to their customers. The cost of maintenance is negligible.

The writer recommends that all heating companies stress the automatic temperature control and thereby slow down the customer's meter at night and on mild days. Help your customer stop his flow of heat when he doesn't want it and doesn't need it. In closing, it is again suggested that utility companies divert the "waste heat" they are selling at their lowest rate to a dissatisfied customer and sell it to another new customer who is willing to pay the higher rate, thereby making two satisfied customers. Recommended economies of this nature serve to increase the popularity of central heating and assure its eventual universal success.



Tests in Building Served With Central Station Heat

Conservation and Oil Burning

By William T. Dean

Vice-President, Combustion Fuel-Oil Burner Company

AT FIRST glance the reader may think we are trying to mix oil and water, but real conservation is the utilization of our resources for the greater good of the greatest number of people.

The automobile has created such a demand for gasoline that our papers are full of discussions of the future supply, but for every gallon of gasoline produced there is also produced three to four gallons of less costly by-products. Of these by-products the preponderating amount is fuel-oil which constitutes at least half of all the crude petroleum produced.

By no stretch of the imagination can we conceive of our transportation facilities being curtailed by any policy of conservation not dictated by dire necessity, hence the only question for discussion is how best to utilize our fuel-oil for the greatest good.

At present great quantities of oil are being burned in marine boilers at enormous loss, since the Diesel engine will drive the same ships on less than half the oil now used in boilers. Real conservation then points the desirability of limiting the oil supply for marine transportation to Diesel engine-driven ships.

WHEN COAL IS A BETTER BUY

Where coal may be delivered in cars or boats directly to storage and handling machinery, adjacent to modern boiler plants, and where such plants are equipped with stokers or pulverizing machinery and ash-handling equipment, power may be generated at costs far below those obtainable with oil fuel. Modern power-generating plants are located with reference to coal transportation and condensing water and when use is made of all the available mechanical means for handling coal, firing boilers, and removing ash, the labor item is little, if any, larger than for an oil-burning plant similarly located.

There is, therefore, small excuse for burning oil for steam generation in large units for power purposes except in localities remote from coal supply and adjacent to oil fields. The abuse of these simple fundamental considerations constitutes a violation of the very principle of conservation and should be prohibited by Federal statutes.

WHERE OIL MAY BE BURNED TO ADVANTAGE

Where then may oil fuel be used if it be forbidden for general steaming purposes?

1. To replace coal where by reason of high cost of transportation, distribution, and firing the relative *value* of oil is high.

2. To replace expensive grades of coal where, for aesthetic reasons, these grades have been used for generations.

3. To replace the dwindling supplies of natural gas.

4. To furnish automatic heat *supply* in isolated plants.

5. For certain industrial heating operations where its convenience and great heat intensity obtainable by its use render it almost indispensable.

Throughout the States of Wisconsin, Minnesota, Nebraska, and the Dakotas, for example, coal costs are extremely high, for to the mine cost is added the cost of long rail hauls, plus a jobber's profit (or two), plus a dealer's profit, plus interest on coal held in storage, plus cost of delivery in small lots to the consumer. On the other hand, in these same States oil may be obtained by relatively short rail hauls or by pipe line, and the consumer is not threatened with strikes, penalized by depreciation, nor does he have to pay profits to so many intermediary agents. True conservation indicates the use of oil fuel in these regions and the people are purchasing and installing oil-burning equipment as fast as possible.

In certain other regions, such as New England, the eastern Atlantic States, and the choicest suburban communities of nearly all large cities, the use of anthracite coal has become habitual because of its relative cleanliness and smokeless combustion. In such communities the oil burner is a welcome improvement for it does all that anthracite coal can do and more, and often at less cost.

CONDITIONS IN NATURAL GAS FIELDS

Throughout the region where natural gas has been available a survey shows that the areas served by natural gas are constantly diminishing, the price constantly advancing, and the supply, particularly in cold weather, extremely uncertain. Thousands of isolated heating plants in these regions are equipped to burn gas only, the boilers, furnaces, etc. being entirely unfitted to burn coal. The application of a properly-designed oil-burner is feasible in nearly all such plants so that the householder may have all the cleanliness and comfort of the gas burner without its dangers, and at less expense for heating.

Last year comparatively few local heating contractors could be interested in oil burners. This year by reason of articles printed in THE HEATING AND VENTILATING MAGAZINE, and other journals, and discussions at conventions of the fraternity, hundreds of men in this industry are now regularly installing reliable oil-burning equipment.

ATTITUDE OF ONE OIL-BURNER MANUFACTURER

At least one long-established manufacturer of such equipment has flatly declined to do business

excepting through the recognized heating trade channels, thereby adding to his own staff the forces of thousands of master fitters and their local organizations. This manufactuer is conserving our resources in oil, coal, and human labor.

WOULD CONFINE USE OF FUEL-OIL TO HOMES AND ISOLATED PLANTS

Fuel-oil should be confined to the five uses listed above for there it finds its greatest value, and there it provides the greatest good to the greater number. Four years ago I said before a meeting of the American Society of Heating and Ventilating Engineers that fuel-oil should be conserved for home and isolated plant use and I believe time will see attempts at legislation in protection of this most valuable use of our most valuable natural resource.

At the risk of repetition, I want to define fuel oil, as much misunderstanding still exists regarding it. Fuel-oil is the *residue* from the distillation of crude petroleum.

Distillates are the derivatives from the distillation such as gasoline, naphtha, kerosene, distillate, (light and dark) and gas oil (light and dark). Thousands of oil burners, many very inexpensive, burn kerosene and the lighter distillates successfully. Others, perhaps a hundred, burn the heavier distillates, including dark gas oil—a very few burn fuel-oil and to these few belong the oil heating business of the near future when all the distillates are "cracked" into gasoline and fuel-oil. Some unscrupulous manufacturers of burners advertise to burn the cheapest of fuel-oil when, in reality, their equipment cannot handle any oil heavier than 30°-32° gravity gas oil. Their customers will awaken one day with cold fear when the distillates are gone.

THE IMPENDING SHORTAGE OF DISTILLATES

The oil-producing and refining companies are warning the trade against the impending shortage of distillates and strongly urging the use of fuel-oil, meaning, of course, the residue. "The Truth About Fuel Oil," published by the Empire Refineries, 1924, contains these statements:

"A home-heating fuel-oil system that will render satisfactory and economical service for a period of only one or two years is not desired by consumer, oil marketer, or refiner, or even burner manufacturer. A burner that will last only one or two years is obviously not to be considered, so also a fuel that will not be available in commercial quantities or that is not well distributed, at economical costs, cannot be considered.

"It is obvious, however, to any investigator that the supply of kerosene and lighter distillates will not long continue to be adequate to even take care of the present demands.

"On the other hand, the heavier grades of fuel-oil will continue in abundance. The system designed to burn crude oil with the gasoline and kerosene removed would undoubtedly be most ideal.

"It is now feasible to buy even the heavier grades of fuel-oil within as narrow limits of gravity and cold test, as kerosene or the lighter distillates. It is well known that the heavier grades of lower gravity fuel contain the largest number of British thermal, or heat units per gallon. This is just another reason for advocating the use of heavier fuels."

Aside from consideration of future supply, the user of an oil burner which is confined to kerosene and the light distillates is faced with four unpleasant conditions.

1. His cost of operation will be 40% higher than his neighbor who burns fuel-oil.

2. His home will always have the disagreeable odor of kerosene.

3. He is increasing his fire hazard while the fuel-oil burner decreases it.

4. His oil burner is inherently noisy if the fuel is burned efficiently because of the low flash point and extremely rapid combustion.

In the interest of conservation of fuel:

Don't buy a burner which cannot burn residue fuel-oil at least as low as 24° gravity. Ask the dealer or manufacturer what *gravity* oil is used and insist on writing it into your order.

Don't buy a burner because it is cheap. You will pay in full in cost of operation, smoke, and smell.

Don't buy a gravity-feed burner under any circumstances unless you want to collect the insurance on your house *and your family.*

Don't buy a burner "without a motor," for fuel-oil cannot be burned successfully without some means of breaking it up into fine particles. Even kerosene cannot be burned economically in sufficient quantity to comfortably heat a cottage without some motor-driven mechanism.

Recent Accomplishments in Field of Fuel Conservation

(*Continued from Page* 46)

plant has the supply fan at one corner of the distributing system. Nature did not put the heart of any animal in one corner, but placed it nearly at the center of the distributing system. A fair profit on the contract price could have been saved on this plant in the cost of ducts by putting each fan in the center of its load, and this without the slighest physical prejudice.

Moral: If the heating engineer were permitted to sit in with the architect as the first sketches are made, working always to the end that the proper understanding shall be given as to the reasons for everything, and if he shall thus develop the building plans along with his developing mental picture of the apparatus which it shall house, then it becomes possible to design for that building a mechanical equipment which will be both adequate and economical.

Operating Figures on a House-Heating Oil-Burning Installation

Results of a Test Conducted by a Chicago Heating Engineer in an Installation in his Own Home, With Comments on the Merits and Shortcomings of Oil-Burning

By J. C. Hornung *

THE object of this investigation was to determine (1) the capacity of an oil burner to heat the writer's home comfortably in the coldest weather, (2) the fitness of the burner to give continuous operation without undue care and adjustments, (3) to determine the burner's ability to burn oil of varying gravity, (4) to determine the burner's fitness from the safety standpoint, and (5) to determine limitations for automatic operation. B. T. U. efficiency of the burner was not checked as it is impossible to arrange a residence for a test of this kind, which would give any degree of accuracy.

The residence is two-story brick, with full basement, and has ten rooms, including sun-room and sleeping porch, both sun-room and porch being heated. The basement is also heated throughout, with the exception of the cold-room. Location of residence is such that wind protection is limited to surrounding trees only.

The heating system is a standard low-temperature two-pipe water gravity system, employing a 34-in. round boiler and cast-iron radiators, about two-thirds of which are window-type. Based upon accepted formulas, the radiation requirements for water heat are 1208 sq. ft. of radiation.

The temperatures were automatically maintained at 72° F. from 5:00 A. M. to 10:00 P. M. and at 66° F. from 10:00 P. M. until 5:00 A. M. No attempt was made to run an economy test by curtailing on ventilation.

A burner of the nozzle type, known as the Combustion burner, was used. The automatic regulation was of the Powers type, which employs the Hornung "snap-switch" contacting devices. This regulation is composed of room thermostat, compound gas pilot, boiler control and automatic relay switch, as approved by the underwriters.

TEST EQUIPMENT

To conduct the test a separate electric meter was installed on the motor-driven pump. A separate gas meter was installed on the gas pilot. A measuring tank was installed on the oil line, so that the oil consumption per hour could be measured accurately. A mercury gauge was installed at the nozzle to determine accurately the air pressure. To maintain the air pressures a special relief valve was installed. A 24-hr. time chart was attached to the compressor so that the idle and operating hours could be determined. Finally, a thermometer well was placed in the oil line at the nozzle to check and experiment on oil temperatures; air temperatures were similarly tested. Oil was supplied to the service tank from a 1000-gal. storage tank placed outside of basement wall.

Readings were taken at 7:00 A. M. each morning and the test extended from January 1, 1923, to May 1, 1923. The oils used were fuel-oil as low as 28° Baumé and distillates running from 36° to 40° Baumé. CO_2 readings were taken from time to time and carbon and soot conditions observed, especially in connection with draft and air supply.

SUMMARIES AND CONCLUSIONS

The mass of data accumulated during the four months of testing cannot be presented in detail, but the summaries and conclusions are here given. Before presenting the findings, however, a word should be said relative to the boiler and burner. The burner was installed February 1, 1922, so that nearly a year's operation was had before the test began. During this time a number of changes were made in the setting and especially in the fire-box. The fire stream was finally held at about 22 in., with the end impinging against a fire-brick wall set somewhat back of the center of the fire-box. With proper adjustment of nozzle, no carbon was deposited on the bridge wall and no excess soot was accumulated in the upper passages.

The combustion chamber, or fire-pot, took on a white appearance which was due to a very thin coating of ash, or the non-combustible part of the fuel. Knowing that soot never is white, this was used as a sort of efficiency guide.

With the draft carefully analyzed with a CO_2 indicator, some rather interesting things happened. It was found that the fire stream should be fairly close to the bottom of the fire-box and that the air should follow the fire stream. With the back draft almost closed, the air supply was fairly automatic and the chimney losses very low. It should be fully understood that this applies to a given boiler and that other boilers may, and, no doubt, will, require different treatment. The fact remains, however, that certain fixed priciples of combustion must be recognized and followed.

CAPACITY OF BURNER AND COST OF OPERATION

We will take up first the capacity of the burner and under this heading we will include the cost of operation. Readings were taken at 7:00 A. M.

* Mr. Hornung has been actively identified with the house-heating industry for the past 25 years and has developed several controlling devices in connection with central heating and, more recently, for oil-burning apparatus.

each morning and on February 12, 1923, the capacity was tested, as this was the coldest day and required the most hours of continuous operation. The burner adjustment called for 2 gal. of oil per hour and this setting, with the absolute pressure control, made the oil consumption for practical purposes, a constant. The data for this particular day follow:

Time chart (24-hr chart)	16 hrs. 20 min.
Outside temp., deg. F., maximum	8
Outside temp., deg. F., minimum	3
Outside temp., deg. F., mean	2.3
Inside temp., deg. F.	69–70
Wind velocity, miles per hour, maximum	42
Weather	Fair, continued cold.

Air and oil pressures were 1 lb. and 14 oz., respectively, at the nozzle—considerably below the maximum—so that the matter of capacity was no longer in doubt. It might be said here, relative to air pressures, that the pressure named seemed to be all that was required to break up the oil stream. Higher pressures, apparently, did not add to the heat given up, that is, the efficiency.

As to the cost of operation, the following is of interest:

Electric current, January 1 to May 1, 172.8 K.W.H.
Gas, January 1 to May 1, 4740 cu. ft.
Periods of operation;

January, total,	744 hrs.; operating	231 hrs. 10 min.
February, total,	672 hrs.; operating	282 hrs. 20 min.
March, total,	744 hrs.; operating	236 hrs. 20 min.
April, total,	720 hrs.; operating	107 hrs. 10 min.
Total	2880 hrs.	857 hrs. 00 min.

Electric consumption in watts per hour, 202.

Gas consumed in cubic feet per hour (total hours, 2880), 1.6.

Gas consumed in cubic feet per hour (operating hours, 857), 5.5.

Having at our command the tabulation of many years of observation on annual heat requirements, the annual cost may be estimated as follows:

3000 gal. of oil @ 7c.	$210.00
300 K.W.H. electric current @ 10c.	30.00
900 cu. ft. gas @ $1.00	9.00
Total	$249.00

These figures are for the residence above referred to and tally very well with the cost for the past season of 1923–1924. This same residence heretofore required approximately 18 tons of hard coal, so that from the standpoint of annual cost of heat, the proposition is satisfactory, no account being taken of coal dust, ash handling, etc.

OPERATING FEATURES

In the matter of continuous operation, very much may be said against oil burners and the writer's observation is that it applies generally. This is not in any way throwing cold water on the industry, but rather an appeal to the promotors and manufacturers of oil-burning apparatus to get both feet on the ground and stop trying to sell the impossible. A burner may be well designed by a competent engineer, both as to the mechanical design and combustion design, and yet be a failure when badly installed or installed in connection with a poor heating equipment. In such a case the industry is made the greatest sufferer. The writer must confess that it was some time before he felt really easy about the oil burner in his own basement, but the thought always prevailed that it could be made to do the work as intended.

The past season has demonstrated to his satisfaction that a burner will "stay put" if properly designed, properly installed and given a proper oil.

SAFETY OF OIL AS A FUEL

As to the safety of oil as a fuel, much depends upon the infallibility of safety devices and upon the grades of oil used. A test made on 30°–32° fuel-oil indicates that the high flash-point makes it a very safe fuel. Four gallons of it were sprayed into the furnace and then ignited in the usual manner, that is, with gas pilot. Not even a puff resulted. This practice is not recommended as an "indoor sport," but it does show that explosions are unlikely in a proper setting.

Regarding the quality of oil most suitable for house heating, there naturally will be a wide difference of opinion. All engineers, however, will agree on the proposition that no burner can successfully and automatically burn a fuel that is not uniform or that is not clean. It is fair to say that much of the industry's troubles have come from attempting to burn "anything that will go through a pipe."

The oil must be uniformly thick or thin at the full range of temperatures encountered and in this the fuel-oil supply companies will be obliged to do their part. It is to be fully understood that this applies only to automatic operation. For hand operation, where generating and atomizing devices are under continuous observation, the fuel, one would suppose, may be "most anything."

Preheating of the oil seems not to get us enough to pay for the trouble, at least, for oil thin enough to be acceptable for automatic burning. This appears to apply to the air as well, although a more exhaustive test on this point may reveal something different. The theoretical air supply, as may be registered by a CO_2 indicator, apparently does not hold as a measure of efficiency. It appears that some excess air gives better net heat per pound of fuel than does an exact supply of air. It should always be borne in mind that in striving for greater gains, until the gain exceeds the cost, no advance is made.

The findings here given are presented with the hope that the oil burner industry may be advanced to some extent, and if the writer may add a word of warning, it is that he who attempts to omit the "art of heating" from the industry is doomed to failure.

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WHEN the anthracite operators come to the point of staging a traveling exhibit of the economies possible with anthracite coal, it is evident not only that they are aroused by the encroaching competition of other fuels, such as soft coal, fuel-oil and gas, but also that they have some good talking points to support their position. As is well known, the operators are advocating means for burning the smaller sizes of anthracite and point out how cheaply these sizes may be obtained. That they have made a "dent" with their campaign is shown by the trend, which is becoming quite noticeable, towards the use of forced-draft blowers in connection with heating boilers for utilizing anthracite sizes as small as rice. In East Orange, N. J., for instance, it is reported that the Board of Education during the past year cut its coal bill from $38,250 to $17,250 through the substitution of rice for egg coal, as previously used. Also in Newark, N. J., the results obtained in two trial installations of forced-draft in 1923 were so impressive that the Newark Board of Education recently decided to equip the entire school system of Newark with forced-draft blowers, at an estimated annual saving of $48,000. In many ways the trend towards the use of small anthracite coals in heating boilers equipped with blowers marks the most important development of the year in fuel conservation.

DESPITE all the data which have accumulated in recent years on the use of insulating materials in building construction, the statement is made that "there has been practically no attention given to the possibility of fuel saving by the proper application of the insulation data thus made available." This may not be entirely true as applied to the entire building field, but when it comes to the heating industry, it strikes pretty close to home. As has been pointed out, the blame rests with the architect and owner who fail to call in the heating engineer in the initial stages of the building design and thus fail to get the benefit of his advice on building materials and methods which would reduce the cost of the heating equipment and of its operation.

"That may all be true," declared one architect, in discussing the matter, "but how are you going to get the owner to pay for the extra cost of insulating his building?" Well, if the figures given out in a report of the Armour Institute of Technology mean anything, the difference in the initial cost of the heating equipment is often more than sufficient to pay for the insulation. In the case of a recent building erected in St. Louis, it is a matter of fact that the original estimate of the heating plant was cut $2200 by the application of metal weather-stripping alone, whereas the cost of the weather-stripping came to only $2300. This made the initial cost to the owner $100.00 higher than without the weather-stripping, but that does not take into consideration the lower operating costs made possible through window insulation alone.

The situation provides both a duty and an opportunity to heating men. With such convincing arguments as to the economy of thoroughly insulating buildings, there is nothing heating engineers and contractors could do that would so enhance their reputations and give them their "place in the sun" before the American public, as to be the ones to effect a nation-wide reduction in the standard costs of heating equipment for our buildings.

IN VIEW of the long-continued efforts on the part of both heating and plumbing contractors to secure the separation of contracts in public building work, it comes as something of a shock to hear that the Washington authorities are not only unwilling to adopt this as standard practice, but present lengthy arguments as to why it is often advantageous to deal only with a general contractor. It is evident, however, that they recognize the wisdom of awarding separate contracts under certain conditions, for their resolution states that "no action (shall) be taken which would place any restrictions upon the authority of the heads of departments and independent establishments to exercise discretion as to the manner of awarding contracts or subdividing the work to be done."

To summarize the reasons given for the decision, one was that separation of contracts would restrict the freedom of action of heads of departments. Another was that it would be of doubtful value from the standpoint of actual economy. It was further argued that it would take away from the Government the advantages in the use of the general contractor's organization. Finally, it was claimed that it would tend to delay the performance of the work. Of these we should say the real issue hangs on the question of economy and, if that is so, the heating industry, for one, can put up a convincing case for subdividing the work.

Why Buckwheat Bucks

Some First-Hand Experiences with this Fuel in Small House-Heating Plants Which Indicate the Difficulties to Be Overcome in Making Its Use Universal

By H. W. Pfeffer

Manager, Power Apparatus Department, American Blower Company

IF PRINTER'S ink and loose talk were the essentials, buckwheat sizes of anthracite coal would be in general use to-day for home heating. The future possibility of one standardized size of anthracite is probably too much to hope for, but there is no question of there being too many sizes. However, buckwheat as it is now produced is the burning question. We find here a tremendous tonnage for which there is a very limited and none too satisfactory domestic or home-heating market.

It should be understood that the accompanying discussion does not apply to the burning of buckwheat coal in apartment houses or similar buildings where larger boilers are used, or to magazine-feed boilers or power boilers, but only to small house-heating installations where the grate area is so small that it is impossible to put a charge of coal in the boiler which will last throughout the day, without completely covering the fire and changing the boiler or furnace into a gas producer.

Details of the tests here referred to and the resulting type of design which is expected to provide a solution of the problem of burning buckwheat coal in the home, will be presented in a later issue.

Buckwheat as a product, when compared with the larger coal sizes, is reasonable in cost, and an ideal fuel, yet it has not been within the grasp of the much-worried home-owner whose yearly coal bill is like a crown of thorns. This situation finds us with a producer having a large portion of his product to market favorably and the home-owner, his customer, anxious to buy, but unable, as a rule, to use this product.

DRAFT THE STUMBLING BLOCK

On the face of it, all that keeps these two apart is Draft. Here is an all-important factor and apparent stumbling block, yet we are all familiar with it. The term draft has little mystery attached to it and is quite generally used, yet buckwheat coal is not in general use for home heating.

There are dozens of draft-producing contrivances on the market which produce draft in sufficient quantity and intensity to burn buckwheat. The art of making wind or moving air is almost as old as the fuel. Anything set in motion creates air movement and small blowers with catchy names are becoming more numerous every day.

All one has to do is to buy buckwheat coal, any size, the smaller it is, the more the saving. Then purchase a little blower, connect it to your ash-pit, wire up to the nearest lamp socket, leave ashes on the old grate or put up a wire screen or some contrivance on the grate to hold the coal. Start up the motor and you will burn buckwheat, providing the motor "motes" and the furnace holds together until you learn how to fire it. But the chances are Mr. Home Owner will gain more respect for buckwheat with each buck. However, if he puts up with it, he'll show a saving in his coal bill, but the chances are for "safety first" reasons, with the ordinary installation, he will go back to the more domesticated sizes.

WHY BUCKWHEAT DOMINATES THE COAL SITUATION

There is nothing new, either in the size of this fuel, its burning or with anything connected with it, which leads one to ask, why this recent agitation over the subject. The situation is just this. The price of nut, stove and egg sizes of anthracite coal has risen to a point where the consuming public must almost do without it or hunt substitutes and, right now, there is nothing to indicate that the coal operators who mine the coal, or the distributors who deliver it to the cellar, can cut their prices materially. Their costs now are approximately as high as they ever were. Their fixed charges are practically at the peak. So that as far as the "head of the house" is concerned, the item in his budget for heat stands a fair chance of remaining as it is, or rising.

In almost every industry we find that recent years have brought a better understanding between the producer and the consumer. Maybe publicity and the belligerent attitude of the consumer have been prime movers in this much-to-be-praised condition, but, regardless of the cause, we find the anthracite coal operators, or so-called "coal barons" putting forth every effort at their command to develop and put into the hands of the public a reasonably-priced fuel for home heating. True it is that, to some extent, the future success of this industry demands it.

The immediate solution of this problem is the by-product of the larger sizes, our much-talked-of, but not easily-handled friend, buckwheat. This coal can be marketed for approximately half the cost of the larger sizes, has approximately the same heat value, is just as clean to handle and there is available from 10 to 15 million tons a year for home use.

RECENT IMPORTANT EXPERIMENTS IN BURNING BUCKWHEAT

For many months, experiments have been carried on by the engineers of the Anthracite Economies Company, a company owned by a number of the largest anthracite coal producers, and the American

Blower Company, with the idea of providing a mechanical system of producing proper draft and preventing gas leak and gas explosion when burning buckwheat coal. The object of these experiments was not to supplant magazine-feed boilers or re-design heating elements or systems, but to provide the existing small house-heating boiler or furnace with equipment which would safely and economically burn this fuel.

INDUCED DRAFT FAVORED

The months of experimenting show that, for general application, forced draft, or blowing into the ash-pit in small heaters in the home, is not practical. Induced draft, which is nothing but a mechanical chimney, is the proper form of draft, not only for uniform burning, but to prevent gas leak.

Next, it was found that when a furnace or boiler is heavily charged with green fuel, it is nothing more than a temporary gas producer and when the first flame broke through the bed of fuel and ignited the gas in the combustion chamber an explosion of minor or major importance always resulted, this being the "buck" in buckwheat. This was overcome by providing a special metallic stand-pipe, which is a part of the grate starting in the ash-pit. Rising through the ash, burning fuel, green fuel and above the maximum coal level into the combustion chamber, the draft pulling through this stand-pipe mixed gas flame and oxygen and created an ever-present pilot light, always insuring flame in the combustion chamber and removing the explosion hazard, which has held back the sale of this fuel.

These experiments proved that at last a fool-proof method which could be installed anywhere, with no need for special firing precautions or limits as to the amount of coal per charge, had been found. In other words, a way was now provided to burn buckwheat anywhere by anybody.

Then comparative tests were run per standard test code, comparing No. 1 buckwheat with stove-sized anthracite and the results show that, pound for pound, it was possible to generate the same heat. The flue temperatures were approximately the same and the firing periods were kept the same. So that for the consumer, the system may be expected to duplicate his present coal-heating performance with no more work and cut his coal bill possibly in half, besides giving more uniform heat.

"ARRIVAL" OF BLOWER EQUIPMENT FOR BURNING BUCKWHEAT IN HEATING BOILERS

Burning Low-Priced Coals in Heating Boilers

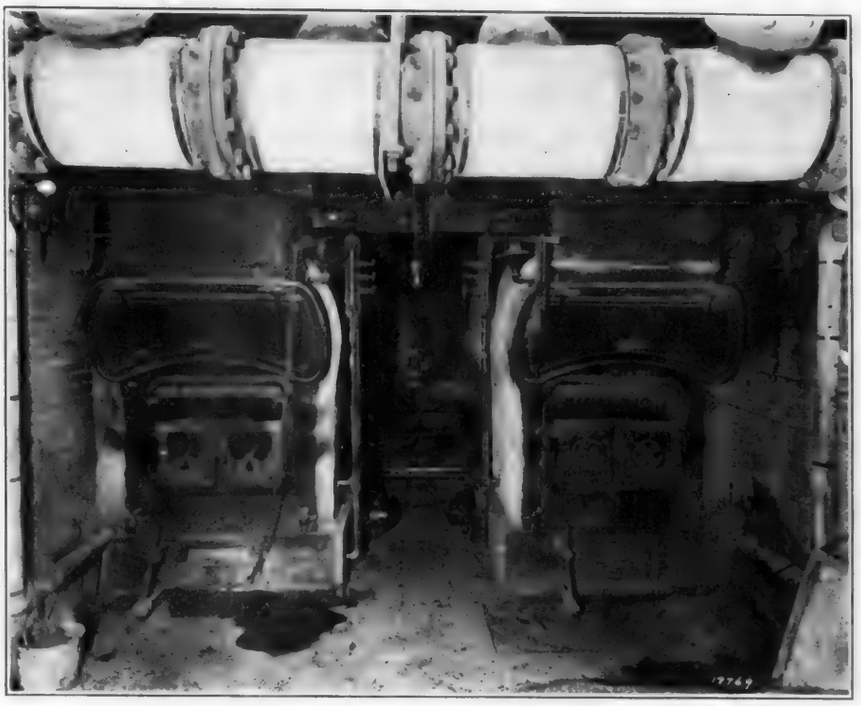
Some remarkable accomplishments have been reported recently in connection with the burning of small anthracite coals or low-priced bituminous coals in heating boilers, in place of the more expensive pea, egg or nut in the anthracite district, or run-of-mine in the soft-coal district.

For instance, the Board of Education, of East Orange, N. J., last year cut its coal bill from $38,250 to $17,250 through the substitution of rice coal for egg coal, as previously used. Here are the details:

Number of school buildings...	10
Number of heating boilers...	28
Average coal tonnage consumed by system in recent years, tons.....	3,000
Kind of fuel used....Anthracite Egg Coal contractor's price for 3,000 tons @ $12.75 per ton.	$38,250
Quantity of anthracite rice coal actually purchased last season, tons	3,000
Total cost of rice coal @ $5.75 per ton (contractors bid)...	$17,250
Difference in fuel cost: $38,250 Less 17,250	$21,000

The results here reported were obtained through the installation in all of the heating boilers of special grates and Wing-type E-M motor-driven blowers. The cost of this equipment completely installed was approximately $14,000, and to this there should be added about $600.00 for electricity for operating the blowers during the year. Thus, with a total installation and operating cost the first year of about $15,000, and a coal saving of $21,000, there remained a net saving of $6,000. With the equipment all paid for, each year, of course, from now on, should show a net saving of from $18,000 to $19,000, even after allowances for operation and depreciation.

One Blower Supplying Two Boilers With Forced Draft



Typical Installation of Forced Draft Equipment for Burning Buckwheat

Similar and proportionate savings are reported in other schools similarly equipped, notably in Milburn, N. J., Montclair, N. J., Rahway, N. J., Bethlehem, Pa., Bloomfield, N. J., and Newark, N. J. The system in Newark is of interest in view of the fact that in the summer of 1923 two schools were equipped as trial installations, the Burnett Street School and the Monmouth Street School. During the past winter these two schools were watched closely and the results were so marked that the Board of Education of Newark recently decided to equip the entire school system of Newark at an estimated annual saving of $48,000. Contracts to equip 24 of the remaining boilers were let early in August as the first step in the changeover.

In addition to the school buildings mentioned, the system is described as equally applicable to apartment buildings, as well as office buildings and industrial plants. To burn these less expensive coals there will be required somewhat more attention, but actually less work. For instance, at the Monmouth Street School, in Newark, the ash removal was reduced from an average of 76 cans per wek to 36 cans. This saving was due largely to the complete combustion effected by the system, as against the losses previously sustained when unburned coal was thrown out with the ashes. Such losses as these are typical of the majority of natural-draft plants.

In firing small coal, it must be remembered that large quantities cannot be spread on the fire at one time. This results in more frequent firing of smaller quantities. It has been found that every half to three-quarters of an hour is the firing period in severely cold weather. This extra attention is more than compensated for in the reduced ash removal and the quickened steaming of the boilers in the early mornings. Firemen can come in an hour or more later and still have the buildings warm in time for occupancy.

The apparatus used in the cases here cited consists essentially of a special small air-spaced grate whose principal object is to prevent the small coals from sifting through to the ash-pit. The pinhole grate, with about 12% to 15% air distribution, has proven very successful in this connection.

To serve the forced draft requirements the L. J. Wing Mfg. Co., of New York, has developed a line of blowers designed to fit practically every boiler on the market. These blowers are small, self-contained units, and are equipped with fully-enclosed dust-proof motors. All motors, unless ordered otherwise, are of the variable-speed type, with hand-regulating rheostats for air control. Thus, with the regulator placed in a convenient location in the boiler room, it is possible to adjust the draft to the exact requirements of the fuel bed.

Cast-Iron Sectional Boiler Adapted for Forced Draft

Sirocco Fans and Culm Burn Grates for Small Forced-draft Equipment

A combination of a Sirocco fan with a Culm Burn grate for burning the lower-priced coals in heating plants, is an evidence of the signs of the times. The accompanying illustration shows the complete installation, indicating the setting of both blowers and the passage of air.

The main object of this equipment, of course, as described by John F. Munder, of the New York office of the American Blower Company, is to burn the cheaper grades of anthracite coal, costing about one-half to one-third a ton less than the sizes heretofore used. The sizes used may be as small as rice and barley. The Culm Burn equipment, it is pointed out, is applicable to any make of boiler.

The apparatus consists of patented water-cooled grates, a direct-connected blower in duplicate, either blower being capable of taking care of the entire load; two motors with variable speed control if direct current or polyphase alternating current is used (if single-phase current only is available, constant speed must be used, with automatic cut-out switch); balanced draft gauges and direct-reading gauges, if more than one boiler is in the battery; and thermostatic or pressure control for air and damper regulation.

The ash-pit is sealed up and air is forced into it, in a manner to provide even distribution of pressure under the entire surface of the grate. On steam boilers the damper regulator is connected by a chain to a butterfly damper in the air duct from the blowers and may be set to reduce or cut off the air supply at any desired steam pressure. This can be balanced so that the steam will be automatically regulated within a small pressure range. A balanced draft gauge is installed over the fire to enable the fireman to set the smoke damper in the proper position to retain the maximum amount of heat in the boiler. In a similar manner, a thermostat can be used to regulate the air supply and so maintain any desired temperature in hot water systems.

The grate is known as a "pin-hole" type, with small discs through which the air is projected into the fire bed. The remaining portion of the grate is made up of long oblong passages through which the water is forced. This water is the return feed water which passes through the grate, where it is raised in temperature and then flows back to the boiler. One result of this design is that the partial cooling of the grate by the circulating

water keeps the clinker soft and spongy. Thus all ash is removed in the form of clinker which, it is stated, does not "freeze" to the grate.

According to tests made with this grate, it is shown that the ash contains less than 5% of unburned carbon, effecting a saving both in the coal burned and in the reduction in cost of ash removal.

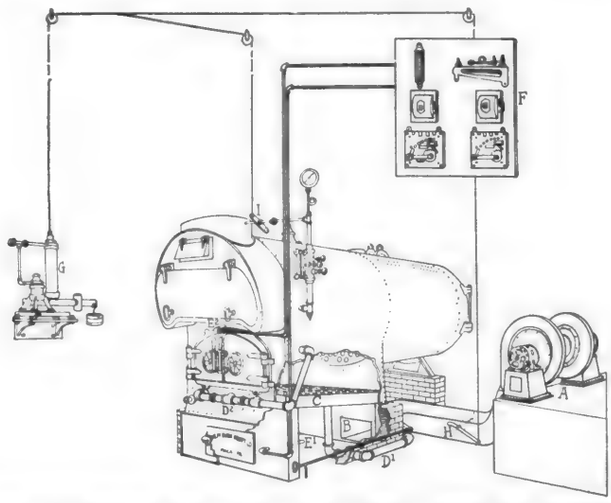
In figuring the proper amount of air needed, the basis is used that 160 C. F. M. is required to perform the chemical act of burning 1 lb. of coal. This figure is obtained by assuming 12 lbs. of air per pound of coal. This, multiplied by 13.4, the space occupied by 1 lb. of air, gives 160 C. F. M.

However, when solving a small forced-draft job of this sort, states Mr. Munder, one usually figures from 16 lbs. to 19 lbs. of air per pound of coal, which gives a large volume, with a small factor of safety.

The pressure required to force the air through the grates and fire bed is figured at from 1¾ in. to 2½ in. water gauge.

To regulate the draft with this outfit, instead of moving the damper, the attendant operates a rheostat which controls the speed of the blower motor.

An electric clock is supplied which will start and stop the blower at predetermined times. A pressure regulator is also provided to start and stop the blower and to keep any desired range of steam pressures, such as from 2 to 5 lbs.



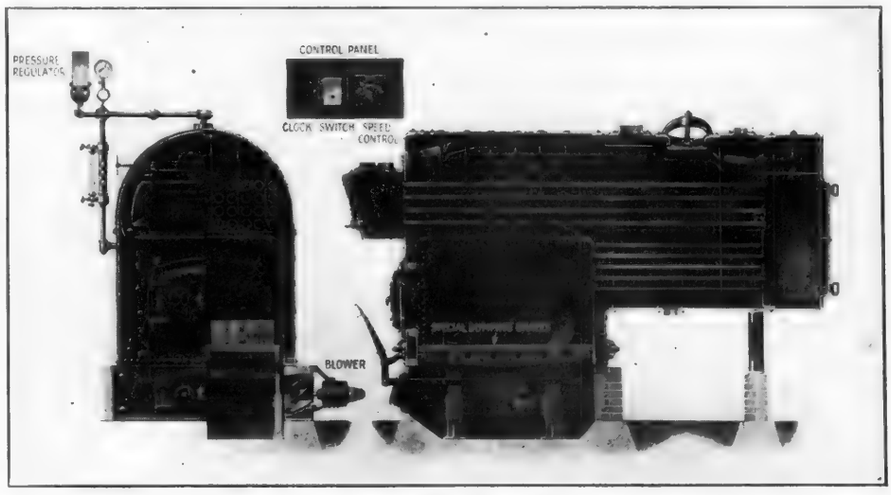
Combination of Sirocco Fan with Culm-Burn Grate for Burning Small Coal Sizes

A saving of one-half of the coal bill, it is figured, can be obtained with this burner, based upon the difference in cost of buckwheat and egg coal.

The Lokol Burner

One of the latest attachments for making it possible to burn the fine sizes of anthracite coal in boilers used for heating apartment houses, offices and loft buildings, has been brought out by the Titusville Iron Works Co., New York, under the name of the Lokol burner. The device consists of a simple and rugged grate, a blower and a regulator. The grate is of extra-heavy cast-iron, made in sections, each of which can be dumped separately. Small perforations offer the minimum resistance to air flow, while preventing the fine coal from dropping through to the ash-pit. It is not water-cooled, and thus does not require extra piping.

The fan motor is of the variable-speed type and is furnished for either direct or alternating current. It is double-enclosed to prevent dust from reaching the moving parts. The cost for current, it is stated, amounts to about 20 cents per ton of coal burned.



Design of the Lokol Burner

Anthracite Coal Economy Campaign

A traveling exhibit, designed to acquaint the public with the cleanliness, safety and economy of anthracite coal, and to show the possibilities of burning the smaller sizes in house-heating equipment, has been organized by the General Committee of Anthracite Operators. The exhibit started from Portland, Me., September 1, and will tour the Atlantic seaboard, visiting 21 cities, remaining in each city one week. In addition, permanent information bureaus or service stations will be established in New York, Philadelphia, Boston and Washington which will be known as "Anthracite Economy Service" stations.

MANUAL OF SMOKE AND BOILER ORDINANCES AND REQUIREMENTS, 1924 edition, has been published by the Smoke Prevention Association. It was compiled by the Public Service Committee of that organization and covers the items of furnace design and requirements for mechanical stokers, gravity-feed furnaces, semi-stokers, and hand-fired furnaces; setting and furnace designs and working drawings of approved furnaces for high and low-pressure boilers; chimney requirements and design and tables of dimensions; pulverized-coal equipment, oil-burning equipment and railroad locomotive equipment; and a standard smoke ordinance and smoke prevention code. The manual will be found especially valuable to municipalities launching anti-smoke campaigns, as it gives information on what other cities have found reasonable and practical, what smoke densities should be prohibited, periods of smoke allowed for starting and cleaning fires, requirements for the installation of fuel-burning equipment, penalties for violation of such ordinances, personnel of smoke-abatement forces, etc.

The ordinances given include those in effect in Chicago, Boston, Cleveland, Cincinnati, Omaha, Denver, Detroit, Minneapolis, Pittsburgh, Des Moines, Harrisburg, Columbus, Toronto, Montreal, Los Angeles, St. Paul, New York, Philadelphia, Salt Lake City, Newark, Grand Rapids, Nashville, Milwaukee, Rochester, N. Y.; Indianapolis, Louisville, Kansas City, Mo.; Springfield, Mass.; St. Louis, Providence, East Cleveland, Akron, Buffalo, Erie and Syracuse.

The manual also contains the Proceedings of the recent convention of the Smoke Prevention Association in Buffalo, June 3-5, 1924.

National Trade Extension Bureau

Automatic Heat Regulation Campaign

Tying up closely with its campaigns on "Heat by Radiators" and "Hot Water for Every Need," the National Trade Extension Bureau is devoting the month of September to a campaign on "Automatic Heat Regulation." In addition to furnishing heating contractors with suggestions for advertising and other publicity work, the T. E. B. *Monthly Service Bulletin* for August contains a number of form letters for soliciting business on heat regulators, pipe coverings and air valves.

How a New Jersey heating contractor scored in a heat regulator sales campaign is told in detail and is an achievement which, no doubt, could be duplicated in hundreds of towns and cities throughout the country. It is such a practical plan and so profitable to all concerned that we are sure the following particulars of it will more than interest our readers.

HOW A GOOD MAILING LIST WAS COMPILED

As told in the *Bulletin*, a New Jersey heating contractor, in starting out on his campaign, took note of the fact that the water department of his city made a practice of keeping a book record of the various types of connections on the property of each consumer. The contractor therefore made arrangements for his bookkeeper to visit the office of the water department and make a complete list of all houses and buildings which had steam and water heating.

CIRCULAR LETTER AND TWO POST-CARDS USED

With this available as a mailing list, the contractor planned to send a circular letter and two post-cards to each name on the list. The letter was along general heating lines, calling the owners attention to the fact that the contractor specialized in heating and had facilities and equipment to take proper care of repair work, alterations and extensions. With the letter he enclosed several pieces of literature, devoted to the advantages of pipe covering, air valves and heat regulators.

Ten days later he mailed a specially-printed post-card, dealing entirely with heat regulation. This post-card was supplied by a manufacturer without cost. The third piece sent was a post-card dealing with the importance of good air valves. Attached to this was a return post-card which the prospect could use to get a free demonstration of the value of the air valve suggested.

RESULTS FROM GENERAL LETTER

According to his own statement, this heating contractor was well pleased with the number of inquiries he received regarding repair work, etc., resulting from the general letter that was sent first. In fact, one repair job he obtained as a direct result of the letter, he claims, more than paid for the cost of mailing the letters. Incidentally, a sales-letter form published in the T. E. B. *Monthly Service Bulletin* served as the model for this contractor's letter.

THE POST-CARD RETURNS

The first post-card proved equally productive and resulted in the sale of four pipe-covering jobs within ten days. The second post-card, however, brought nearly fifty return cards asking for demonstrations of air valves. This flattering response pointed out to the contractor the possibilities of a personal canvass so he decided on extending his campaign in that way.

HOW HE OBTAINED SOLICITORS

To do this he had to have solicitors. He did not care to take on the burden of employing trained solicitors so he decided to make a few. He, therefore, through the secretary of the city schools, sought an opportunity to find such help among the older high school boys. Permission to do this was granted. He made arrangements to talk to the high school boys one day following classes, at which time he pointed out that the boys could make some pin money, as well as learn salesmanship, by working for him. He instructed all those who were interested to put in their application; and told them that he would select one boy from each district.

It is needless to say that he had more applicants than he knew what to do with. Most of them were wide-awake young men, full of "pep" and ambition. Of course, all of them were reasonably well known in the districts they were to work in.

RADIATOR HEAT AND GOOD HEALTH
Every room at the *right* temperature
Much cold weather sickness is due to "indoor exposure"—which results from faulty heating.
Going from a warm room into one that is chilled always invites illness. Children are especially endangered because they play on floors all over the house. Sudden chills and drafts, as well as bursts of excessive heat, are common in the home depending on stoves or old-fashioned furnaces for warmth.
Heat by radiators gives healthful warmth, evenly distributed, at all hours. Radiator heat is clean—keeps soot, dust, ashes and odors out of the rooms—lessens labor and increases comfort.
A modern steam, vapor or hot water heating system assures a lifetime of dependable warmth. It pays for itself in protection to health, alone. It will, ordinarily, outlast the building it is in.
If you have been "living in the room where the fire is"—during past cold weather—you'll enjoy the use of the whole house when you heat by radiators. Equip your dwelling with a modern radiator heating plant now—before cold weather is here, and before the rush begins.
Any of the heating contractors named below will give you prompt and competent service.
ASSOCIATIO
GUARANTEE
Evolution of Househeating
From every Indian tepee smoke rose from a fire in the center of the floor. Pioneer white men built huge open fire-places, from which most of the heat went up the chimney; and keeping warm meant much cutting and carrying of wood. The wood-burning stove was hailed as a stroke of genius because it radiated so much more heat into the room. Then came the coal stove with even greater heating efficiency.
But all of these suffered the same draw-back—the FIRE HEATED ONLY ONE ROOM.
Then came the warm air furnace, sending warmth from a single fire to a number of rooms. Even more recently came the method of circulating steam, hot water or vapor to a radiator in every room.
Finally, automatic regulation of fire control—far more flexible and reliable than human attention can ever be—is now perfected. Continually on watch and immediately responding to the slightest change in temperature, it prevents—alike—either overheating or chilling; thereby avoiding waste of fuel and protecting health and saving work. Modern heat by radiators, automatically regulated, is the acme of house-heating economy and comfort. Ask some member of this association for more particulars.
ASSOCIATION NAME
GUARANTEE

Typical Advertising Suggestions Offered by National Trade Extension Bureau

Typical Advertisements for the Automatic Heat Regulation Campaign

YOUNG SOLICITORS INSTRUCTED BY FACTORY SALESMAN

After making his selection of boys, he had a factory salesman to come to his store and instruct the boys on air valve construction, their function, etc. Each boy was then individually questioned to determine how much of this he had absorbed; and the salesman spent one afternoon with each, making calls.

Then the boys were turned loose to see how many air valves they could sell. They were paid twenty-five cents for the first air valve sold in a building and ten cents for each additional valve.

Some of the boys proved real salesmen, while others proved rank failures. These latter were soon dispensed with and other boys were tried, until a full crew that could produce was secured.

When the city had been reasonably well canvassed for air valves, the boys were instructed, in a similar way, on heat regulators, pipe covering, radiator shields and other heating specialties and similar campaigns for sale of these appliances were conducted.

VENTURE HIGHLY PROFITABLE

Some of these campaigns were more successful than others. But, all in all, the venture was a highly profitable one for the heating contractor. Not only did he greatly increase his list of customers, but the boys picked up several good sized heating jobs and several boiler replacements.

Best of all, however, is the fact that he educated a bunch of high school boys to really know about modern heating apparatus and specialities, who will always boost for his business.

Manager William J. Woolley to Remain With the National Trade Extension Bureau

It became known only recently that William J. Woolley, secretary-manager of the National Trade Extension Bureau, in Evansville, Ind., had tendered his resignation of that office as long ago as the annual convention of the National Association of Master Plumbers, in West Baden, Ind., June 25, last. The reason given was his desire to engage in a private enterprise. At that time the board of directors of the master plumber's association regretfully accepted Mr. Woolley's resignation and appointed a committee to recommend a successor.

The announcement is now made that Mr. Woolley has reconsidered his resignation, feeling that he would be doing his friends, as well as himself an injustice, if he left the bureau without someone, satisfactory to the industry and sufficiently familiar with the work, to take his place.

"Pride," he adds, "also has had a hand in making up my mind to reverse my former decision. The bureau has grown beyond the fondest hopes of all, but we are just beginning to reach a real productive stage. Just now there are many activities that need to be launched. The many important and needed activities authorized by the recent board meeting also need immediate attention for the future welfare of the industry. To announce my resignation now would retard, if not stop, all of these and that must not be done."

Mr. Woolley closes his letter with the suggestion that an assistant manager be appointed who could act as a relief man for the various department heads.

Using a Mail List Profitably

The National Trade Extension Bureau has issued a booklet on the seventh step in business efficiency, entitled "Compiling and Using a Mailing List Profitably." It is a part of the T.E.B. efficiency course for heating contractors and master plumbers and will be forwarded to members of the trade upon application. A small charge to cover postage is made by the T.E.B.

Stressing the old adage that "whatever is worth doing at all it worth doing well" the T.E.B. has compiled a book filled with information on the conduct of direct-by-mail advertising. Subjects covered include: compiling a mailing list; securing and using the names; filing the list and cards; actually using the list; and general information on getting results from the list.

Business Helps For Heating and Plumbing Contractors

Only those who have kept close track of the publications issued by the National Trade Extension Bureau, of Evansville, Ind., are aware of the amount of information which this agency has supplied and is supplying for improving the business methods and extending the fields of both the heating and plumbing contractors. So many requests have been made of THE HEATING AND VENTILATING MAGAZINE, from time to time, for information on some phase of T. E. B. service that we have obtained, through the courtesy of the Bureau, a complete set of its publications and printed matter which have been placed in our library file for the benefit of our readers. Full information, for instance, may be had in these publications of the Bureau's apprenticeship program. The bookkeeping methods suggested by the Bureau involve a number of forms which are included in this file. Other forms cover the Bureau's suggestions for developing new business, and include estimate forms and uniform contract blanks, as well as advertising suggestions (with copy and illustrations). All of the T. E. B. lectures, also its revised course in accounting are contained in the file.

Those interested in securing details of the publications of the National Trade Extension Bureau are invited to visit the office of THE HEATING AND VENTILATING MAGAZINE where they inspect these publications at their leisure.

Smoke Abatement as Applied to House-Heating Boilers

In the interest of smoke abatement, states H. B. Meller, chief of the Pittsburgh Bureau of Smoke Regulation, who has just been elected president of the Smoke Prevention Association, much has been accomplished in the past, particularly in requiring higher settings, better air distribution and proper draft and in the development, comparatively recently, of the so-called "smokeless" heating boiler. However, much remains to be done.

A few of the outstanding necessities were presented by Mr. Meller at the recent convention of the Smoke Prevention Association in Buffalo, and were given in this order:

1. Standardization of Ratings.
2. Air Regulation.
3. Stacks.
4. Automatic Feed.

1. Standardization of ratings. (This applies particularly to the low-pressure heating boiler.)

The man who pays the bill has a right to have information concerning a boiler which he may expect to purchase given him in terms which he can understand and which will enable him to make comparisons with boilers of other makes. It is unnecessary to say that at present such comparison is not always simple. The question a prospective purchaser naturally would ask is: "How much steam will this boiler make, and under what conditions?" The first step toward standardization seemed, therefore, to be to get the manufacturers all to report in the same terms, those terms to be understandable to the layman and comparable between types and makes of boilers; so the manufacturers of all low-pressure heating boilers in use or to be offered for use in Pittsburgh have been asked to furnish the following information or each type and size of boiler having an equivalent evaporation of 500 lbs. or more of water per hour:

(a) Total equivalent evaporation per hour in pounds of clean water, from and at 212° F., at the nozzle 97% dry.

(b) Grate area in square feet used to obtain this evaporation. If upper and lower grates are used, each is to be stated separately.

(c) Total coal required, in pounds per hour, to obtain evaporation in (a) with grates (b) with attention to boiler and fire as may be necessary.

(d) Draft, in inches of water, at the outer edge of the smoke collar, necessary to obtain evaporation in (a) with grates (b) with coal consumption (c). The effective area of smoke pipe and chimney to be at least equal to the area of the smoke collar on the boiler.

Tests are to be made in accordance with the code for boiler testing, issued by the American Society of Heating and Ventilating Engineers, except that data are to be furnished for bituminous coal of 13000 B. T. U. value and 30% to 40% volatile content, and are, of course, to be guaranteed by the manufacturers furnishing them. It is believed that this offers a standard which can be adopted by any city using bituminous coal.

WHY A REVISION OF RATINGS IS NECESSARY

A number of conferences were held with manufacturers representing most of the output of low-pressure heating boilers in the country; they agreed that the information asked was entirely fair and would tend to standardize ratings.

Some of the questions asked then or since are:

1. Q. Why ask for rated capacities in pounds of steam instead of in square feet of radiation?

A. Because the steam boiler has nothing to do directly with radiation. Its function is to evaporate water. The manufacturer should not be held responsible for the rest of the job.

2. Q. Why specify the grate area?

A. To figure rate of combustion and to determine thickness of fuel bed.

3. Q. Why specify upper and lower grates separately?

A. To make fair allowance for the area of an upper grate.

4. Q. May steaming capacity and rate of combustion be determined in separate tests?

A. No. The capacity in steam must be shown with the grate area, the coal consumption and the required draft. Otherwise the results as reported would not be dependable.

5. Q. May anthracite be used and then figured to the coal specified?

A. No. Furnace conditions are very different with anthracite than with bituminous coal.

6. Q. Should there be specified a maximum rate of combustion?

A. No. Manufacturers differ in this. High rates of combustion will require more drafts, which will show on the chart it is the intention to publish.

7. Q. Why not specify firing periods?

A. It is unnecessary. Any manufacturer reporting a capacity which cannot be attained in the plant with reasonable attention is fooling only himself. This the first plant test would show and as a result his rating would be discredited.

8. Q. Should the rated capacity be the maximum capacity or the capacity at highest efficiency?

A. The manufacturer may place the capacity at either or at another figure. As the results are reported in steam produced, coal consumed and draft required, the chart will show how it is obtained. Most manufacturers probably will report capacity at or near the point of maximum efficiency.

9. Q. Why not specify stack sizes?

A. For the reason that the manufacturer is interested only in getting the necessary amount of draft and not in how it is gotten. If the stack size is specified and the boiler guaranteed to give a certain performance on such stack, local conditions or a long breeching may reduce the draft below that necessary.

MANUFACTURER SHOULD BE RESPONSIBLE FOR BOILER ONLY

It is the intention to have the manufacturer responsible for the boiler only; the heating engineer will be responsible for the proper breeching and the stack to provide the draft required.

In case of inadequate draft, the prospective purchaser will be shown the penalty he is paying in decreased efficiency; or he may be required to use a boiler with less capacity.

It should be noted that the effective area of the smoke pipe and stack is to be at least as great as the area of the smoke collar. In Pittsburgh, the smoke pipe or breeching will be required to have an area at least as great as the area of the stack specified. Where the smoke collar is smaller than this, the smoke pipe will be flared to the required size. If the smoke collar is smaller than it should be (and some are) the penalty will be on the boiler, not on the smoke pipe or the stack.

WOULD HAVE AUTOMATIC CONTROL OF AIR ADMISSION TO FURNACE AIR REGULATION

With forced draft and regular feed, as with the automatic stoker or powdered coal, this is comparatively simple. With hand-firing, with the consequent intervals between injection of green fuel, distillation of volatile hydrocarbons and coking, and the breaking back of the coke, the requirements are variable, resulting in large excess of air during a part of the time and probably a deficiency of air during the distillation period. The air regulation should be such, whether on high or low-pressure boilers, that the minimum required amount of secondary air will be constantly entering the furnace. When more is required, it should be admitted for the necessary period through auxiliary openings. In high-pressure boilers these are sometimes steam-jets, sometimes panels in the firing doors, and sometimes special openings at or near the bridgewall.

In low-pressure heating boilers there are many kinds of air admission devices, some of which are open all the time, some only during the period of distillation. In practically all cases, however, the fireman is depended upon for their operation. This is the fatally weak point.

To be sure that auxiliary air is going into the furnace when, and only when, needed, it is necessary that the openings be operated automatically. Usually, the best way is to have them to open when the door is opened and to close gradually after the door is closed. It is simple to arrange this, and the wonder is, when one sees, in boiler rooms, air ports either wide open or tightly closed during all stages of

combustion, that any boiler is marketed without automatic regulation of this auxiliary air supply.

Perhaps a word of caution should be given here. A smoke inspector has the right to insist upon apparatus being operated within the law, or to reject it if it cannot reasonably be so operated, but he does not have the right to attempt to control the interior design of a boiler or furnace. If a manufacturer can show that with reasonable care and under normal operating conditions his apparatus will meet the requirements of the local anti-smoke ordinance as it relates to volume and density of smoke emitted, an inspector is standing in the way of progress if he refuses to approve that design. Besides, he probably would not be supported in court in case of an appeal.

STACKS

The system used in Pittsburgh and many other places for calculating stack dimensions is unsatisfactory, for various reasons, among them the high friction loss due to higher draft losses in boilers than formerly, and local conditions which make it untrue to say that a stack of a given size will perform in the same manner regardless of location.

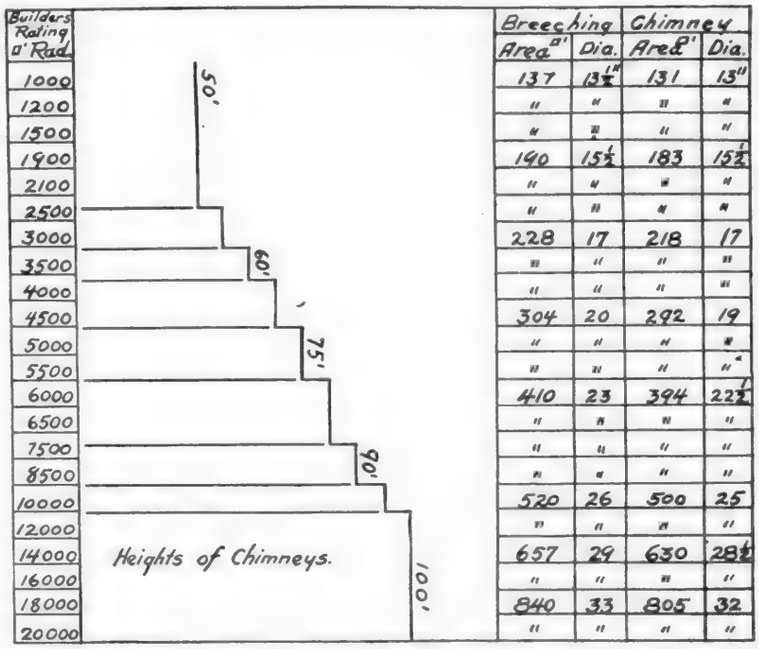
The logical method would be to determine the size of a stack from a gas basis, where volume and velocity are taken into consideration.

(See Trans. A. S. M. E. Vol. 23, p. 1065 Power Nov. 21, 1922 Jour. A. S. H. & V. E. Vol. 29, p. 717)

AUTOMATIC FEED RECOMMENDED FOR HOUSE-HEATING BOILERS

For the boiler now fired by hand, including the smaller sizes used in dwellings, there is needed an automatic feed comparable to the stoker. Such control is entirely feasible and would go a long way toward eliminating the smoke nuisance now experienced in residential sections of cities. In Pittsburgh in particular this nuisance is increasing rapidly, due to the diminishing supply of natural gas and the change from this fuel to bituminous coal.

An automatic feed would eliminate those irregularities that are due to hand-firing, would give higher efficiency, thus reducing the cost for fuel, besides eliminating most of the dense smoke.



Builders Rating 0' Rad.	Breeching Area D'	Breeching Dia.	Chimney Area E'	Chimney Dia.
1000	137	13½"	131	13"
1200	"	"	"	"
1500	"	"	"	"
1900	140	15½	183	15½
2100	"	"	"	"
2500	"	"	"	"
3000	228	17	218	17
3500	"	"	"	"
4000	"	"	"	"
4500	304	20	292	19
5000	"	"	"	"
5500	"	"	"	"
6000	410	23	394	22½
6500	"	"	"	"
7500	"	"	"	"
8500	"	"	"	"
10000	520	26	500	25
12000	"	"	"	"
14000	657	29	630	28½
16000	"	"	"	"
18000	840	33	805	32
20000	"	"	"	"

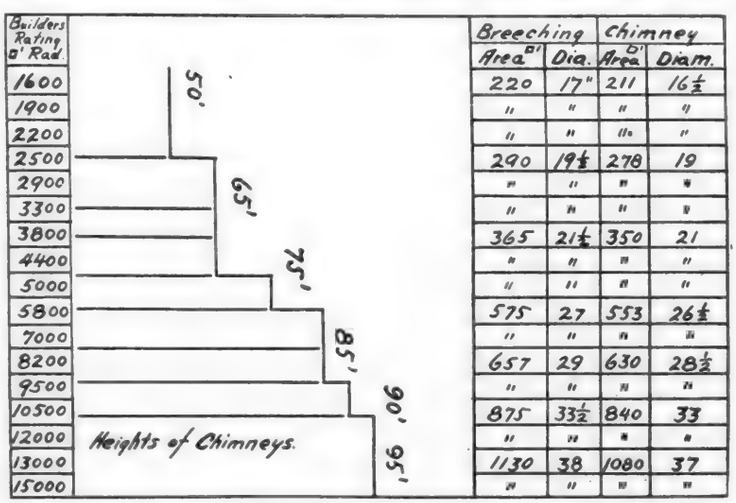
Proposed Minimum Sizes of Chimneys and Breechings for Fire-Box Tubular Boilers—Double Pass

Standards Proposed by Smoke Prevention Association

Included in the report of the Standardization Committee of the Smoke Prevention Association are the accompanying recommendations for breeching and chimney sizes for fire-box tubulars, both single-pass and double-pass and for cast-iron boilers.

The report specifies that fire-box heating boilers exceeding a capacity of 1000 sq. ft. of radiation (manufacturers' rating) should be provided with a down-draft furnace or should employ the down-draft principle of carrying the gases down and through or over an incandescent bed of fuel. Fire-box heating boilers of a capacity less than 1000 sq. ft. of radiation (manufacturers' rating) should use fuel having fixed carbon of not less than 70% and volatile matter not to exceed 25%.

The report also recommends that heating boilers of less than 1000 sq. ft. of radiation, as manufactured, having down-draft furnaces, or providing for the down-draft method of burning fuel (magazine-feed) or boilers of the underfeed type, should be used and bituminous fuel burned therein in preference to the direct-draft heating boiler, using fuel having 70% fixed carbon and volatile matter not to exceed 25%.



Builders Rating 0' Rad.	Breeching Area D'	Breeching Dia.	Chimney Area D'	Chimney Diam.
1600	220	17"	211	16½
1900	"	"	"	"
2200	"	"	"	"
2500	290	19½	278	19
2900	"	"	"	"
3300	"	"	"	"
3800	365	21½	350	21
4400	"	"	"	"
5000	"	"	"	"
5800	575	27	553	26½
7000	"	"	"	"
8200	657	29	630	28½
9500	"	"	"	"
10500	875	33½	840	33
12000	"	"	"	"
13000	1130	38	1080	37
15000	"	"	"	"

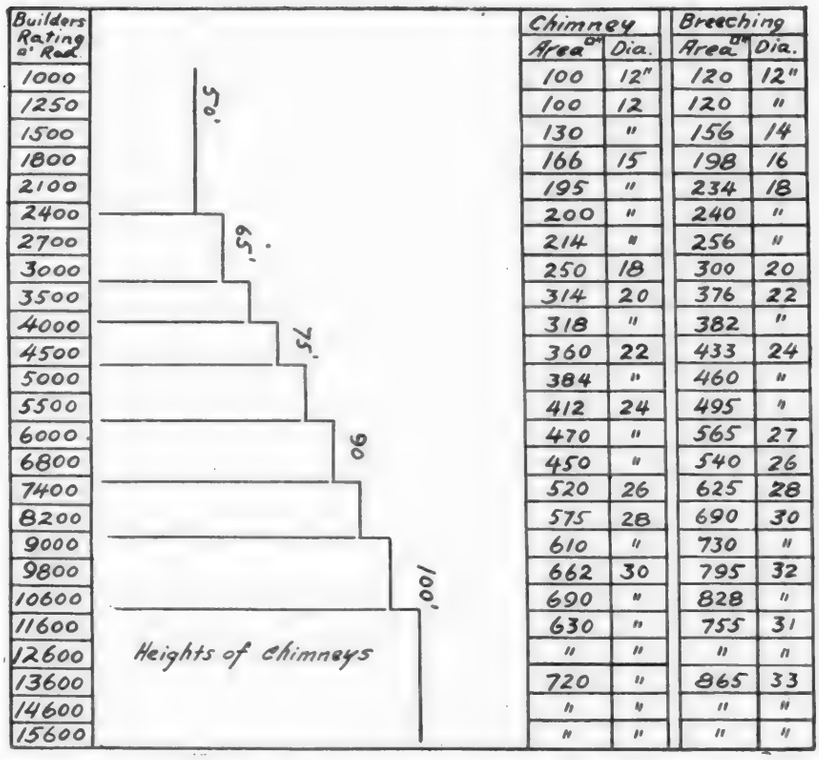
Proposed Minimum Sizes of Chimneys and Breechings for Fire-Box Tubular Boilers—Single Pass

GRATES

Where double grates are used, the upper grate of down-draft heating boilers, according to the report, should have a total air space of not less than 50% of the upper grate area. This area should be uniformly distributed, without large openings that will permit unburned fuel on the upper grate from dropping on the lower grate. The lower grates should have fingered bars, with air space of from 30% to 50%. The sections of grate bars should be so connected as to be operated from the front of the boiler.

BREECHINGS OR SMOKE FLUE

For fire-box boilers (Tables 1 and 2) no cross-section of the breeching, before entering the chimney, should have an area less than 125% of the combined cross-sectional tube area of the boiler.



Builders Rating of Boiler	Chimney Area	Chimney Dia.	Breeching Area	Breeching Dia.
1000	100	12"	120	12"
1250	100	12	120	"
1500	130	"	156	14
1800	166	15	198	16
2100	195	"	234	18
2400	200	"	240	"
2700	214	"	256	"
3000	250	18	300	20
3500	314	20	376	22
4000	318	"	382	"
4500	360	22	433	24
5000	384	"	460	"
5500	412	24	495	"
6000	470	"	565	27
6800	450	"	540	26
7400	520	26	625	28
8200	575	28	690	30
9000	610	"	730	"
9800	662	30	795	32
10600	690	"	828	"
11600	630	"	755	31
12600	"	"	"	"
13600	720	"	865	33
14600	"	"	"	"
15600	"	"	"	"

Proposed Minimum Sizes of Chimneys and Breechings for Cast-Iron Boilers

For fire-box boilers having no fire tubes, the area of the breeching should be not less than 20% of the grate surface.

For cast-iron boilers (Table 3) no section of the breeching should have an area less than 20% of the grate surface.

Where boilers have front uptakes, the horizontal section in front of the boiler should be not less than 50% in excess of the tube area.

A round or square breeching is recommended as preferable to one which is wide and shallow. A breeching of a section in which one dimension is over one and one-half times the other is not recommended. Right-angle bends should be avoided.

For each right-angle bend in the breeching, except the bend at the boiler, 10 ft. additional should be added to the minimum height specified in Tables 4 and 5.

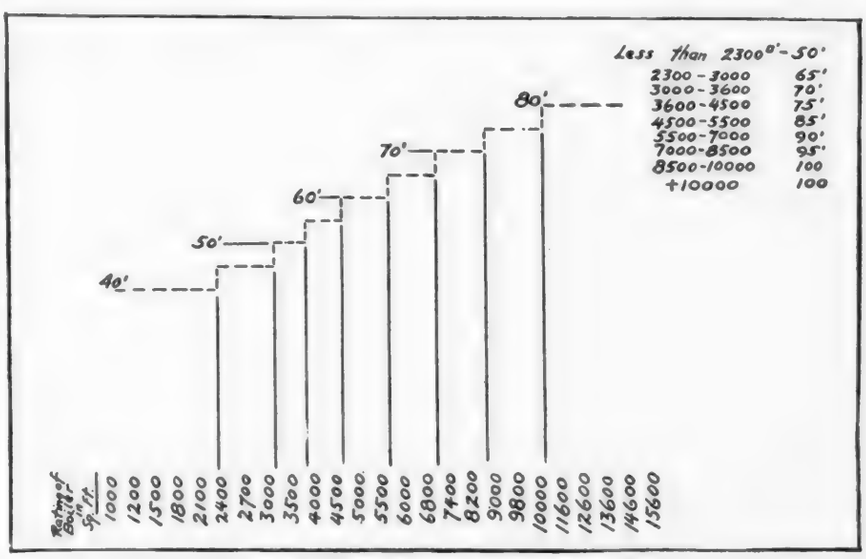
The internal area of chimneys of fire-box boilers (tubular type), shown in Tables 1 and 2, having a ratio greater than 25 sq. ft. of heating surface to 1 sq. ft. of grate surface should be not less than 120% of the combined vertical cross-sectional tube area.

CHIMNEYS

The chimneys for boilers in which bituminous fuel is to be burned should be of a height not less than that given in Table 5, the height to be measured from the grate level to the top of the chimney.

TABLE 5—CHIMNEY HEIGHTS FOR HEATING BOILERS BURNING BITUMINOUS FUEL

Rated Capacity, Square Feet	Chimney Height, Feet
Less than 2300	50
From 2300 to 3000	65
From 3000 to 3600	70
From 3600 to 4500	75
From 4500 to 5500	85
From 5500 to 7000	90
From 7000 to 8500	95
From 8500 to 10,000	100
Over 10,000	100



Chimney Heights for Heating Boilers

Building Costs Doubled in Ten Years

A report by the National Industrial Conference Board, after an exhaustive study of building conditions, points out that building costs in the United States have doubled in the last ten years and asserts that the shortage of building labor has been the outstanding factor in boosting construction costs. In short, it has been the failure of the supply of skilled labor to keep pace with the demand. Immigration restrictions are blamed for this failure in the report.

The conference board points out that stabilization of building at present high costs is forcing the average wage earner to pay for rent a greater proportion of his income than he is justified in doing, or else occupy premises beneath his proper status. A continuance of the present vigorous building program is predicted until a point is reached when the supply so far exceeds the demand as to bring about a reduction in rents and home-purchase prices.

School Buildings Programs in 200 American Communities

While no accurate statement of the exact shortage of school buildings in America is available, the heating and ventilating trade may well look to this field for a steady and voluminous source of orders during the next ten years. A survey of some 200 communities, made by the *American School Board Journal*, of Milwaukee, discloses the fact that practically every one of those cities and municipalities either has a well-defined school building program actually under way or one in process of formation.

The survey shows that school boards of the country are going forward carefully and systematically to build up the educational housing facilities to make up for the War years when only imperative construction was attempted.

Correspondence

Unsteady Water Line Causes Cracked Boiler Sections

EDITOR HEATING AND VENTILATING MAGAZINE:

We are enclosing a sketch of an illustration of a heating job in a building in this city. The boiler is a Prox heavy-duty A-211-6, of 6650 sq. ft. capacity, located approximately 75 ft. distant from the building it supplies. The 6-in. main runs about 45 ft. on the ceiling of the boiler room, drops 5 ft. to about 18 in. from the floor and continues through the tunnel, 75 ft. on a level, to the new building which it heats. The boiler mentioned is installed in the basement of an old building which has no heat at present. The main then rises 9 ft. to the ceiling of the basement of the new building and supplies 1448 sq. ft. of direct radiation and 344 sq. ft. of Vento.

The return follows the main back to the boiler room to a Condovac boiler-feed and vacuum pump unit No. 1040, of 8000 sq. ft. capacity, which sets on the floor level of the boiler.

This work was installed exactly according to the plans and specifications and O. K'd by the architects and his engineers who drew up the plans. The reason for the piping being so large was that they expect to install another boiler and heat the old building at some future time.

The boiler has burst nine sections and there must be some defect in the layout or installation somewhere. We cannot locate it, so are sending out this S. O. S. in the hope that you can give us some information regarding same.

S. W.

About the only thing that could cause the boiler section to crack would be a low water line, caused by the water lifting and entering the system, due to priming. In fact, if an engineer were to diagnose every case of trouble in new steam heating systems as being caused by priming he would seldom go wrong. Nevertheless, the average engineer will more than likely hunt everywhere in a heating system for the cause of trouble, except the right place, which is more often in the boiler than anywhere else.

It matters not even if the system has just been cleaned out. That is not enough, as it may take several cleanings before satisfactory results are secured. After each cleaning the job may work well for a time, then a relapse, but finally the last bit of oil, grease, or core sand will be washed out.

In most cases of priming, trouble can usually be averted by arranging the piping from the outlets so as to drop into a steam header, the ends of which are dripped into the return header at the boiler. In this way, any water carried over will be dropped and also changed in direction so that it is hardly likely to enter the system. The best way of doing this is shown in Fig. 2, but, to save the cost of changes, the piping may be dripped at point "A" and connected to the return on the boiler side of the check valve at point "B" (See Fig. 1).

HOW TO TEST A BOILER FOR PRIMING

A simple way to test for priming is to raise the pressure, attach a chain to the safety valve, and then at intervals pull the valve suddenly open, holding it open for a time and noting meanwhile whether dry steam is discharged. If water is discharged, instead of steam, then it is evident that the boiler and system must be thoroughly cleaned out. This test should be applied at various pressures, as the condensation of course is somewhat greater at the higher temperatures or pressures, so that at such times the velocity of steam flowing through the boiler outlets will be greatly increased and priming more apt to take place.

Any water lifting over from priming will soon enter the pocket formed by the steam main where it drops at the tunnel. Its presence will be indicated if the ear is placed against either the drop in the steam main in the old building or else the rise in the main in the new building, the latter being preferable. Of course it should go without saying that a bit of cardboard should be placed between the ear and the hot pipe.

There is still another method of doing this listening in, a method which may be handier in these days, as it requires the use of a bottle. Put the ear to the neck of the bottle, and place the other end of the bottle against the hot pipe. A steady swish indicates the passage of steam in the pipe, but if surging is taking place it will soon make its presence known by telephoning through the bottle.

There are various ways of cleaning out a boiler, but this and other troubles from priming have been covered by correspondence in other issues of THE HEATING AND VENTILATING MAGAZINE (See August, 1923 and two items in April, 1924).

OTHER POSSIBLE CAUSES OF THE TROUBLE

Perhaps a few remarks on other features of the system as sketched will not be amiss, for, after all, a sketch merely shows design. Even if it truly represents the actual installation in all respects, still it will hardly show the conditions which exist within the piping, nor will it show the working of the apparatus. For this reason, it is well to feel along the return pipe for a cold spot, as this would indicate a partial stoppage at the cold point. This is a condition sometimes found by the trouble man, so it is quite possible that something may have been left in the pipes which would retard the flow of water, causing it to be returned to the boiler at a much slower rate than supplied to the system.

The check valve at the boiler may be lodged in the open position, or the return pump may operate at such long intervals that the water is held up in the system. This would lower the boiler water-line to the danger point, after which the pump might operate and flood the boiler. In fact, anything tending to lower the water-line will contribute to cracked boiler sections. For example, if the system is extensive and the runs rather long it will take some time in starting up before the metal of pipes and radiators is fully heated. In such cases, the large drop in pressure and vacuum, resulting from the rapid condensation of steam, holds back the water in the piping until, with the starting-up period complete, steam is condensed at a normal rate and then the water is returned with a rush.

Again, there may be temperature control valves on the Vento heaters which, in automatically shutting off of

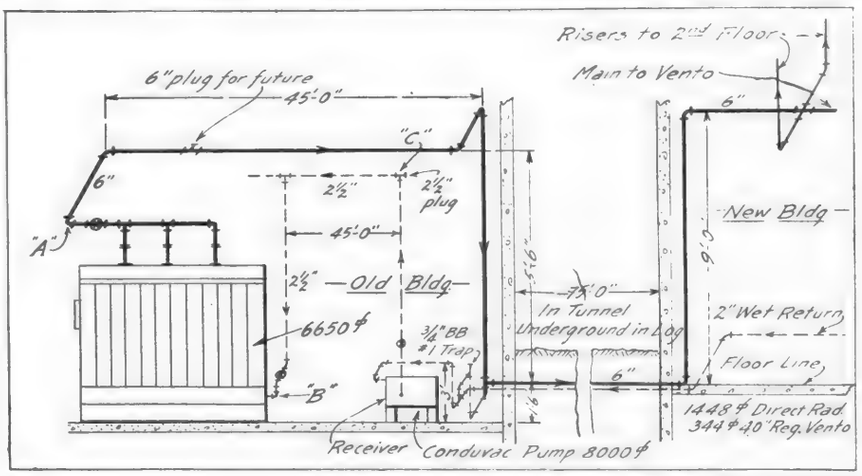


Fig. 1.—Arrangement of Heating System and Boiler Which Had Cracked Sections

the steam supply, cause a vacuum within the heaters as the remaining steam condenses. This would pull back or hold up the return water.

DRIP IN WRONG LOCATION

Another point, though of lesser importance, is the dripping of the drop

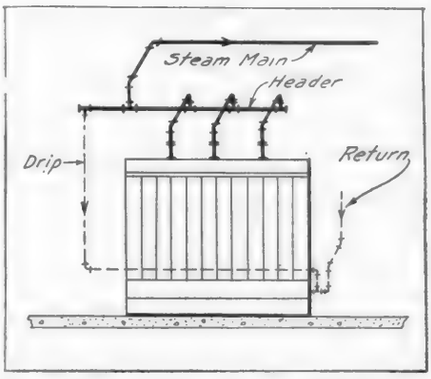


Fig. 2.—Arrangement of Piping at Boiler Outlets for Relief from Priming

or pocket in the steam main at the point where it runs in the tunnel between buildings. This pocket should have been dripped at the rise in the new building and not in the old building. The condensation in this main will flow with the steam to the rise on the other side of the tunnel, but, as now dripped, the condensation must flow back counter to the steam.

The trap shown at this drip point should be thoroughly gone over in order to see that it is properly piped and installed and whether the trap is operating so as to readily free the steam main of water. It would also be well to connect an air valve or open vent pipe at point "C" on the discharge line of the pump, as this will free the discharge pipe of air. This is customary on any return pipe which drops below the water-line of the boiler, otherwise the air is pocketed. Of course, the vent pipe should be carried up to a point where the static head will counter balance the boiler pressure.

T. W. REYNOLDS.

Extending the Vacuum to the Inside of the Radiator

EDITOR HEATING AND VENTILATING MAGAZINE:

Reference is made to Page 87 of THE HEATING AND VENTILATING MAGAZINE for July in which R. C. Miller concludes his letter with the question: "Why do we not extend it (the vacuum) to the inside of it (the radiator)?"

It is assumed that the Washington office building, to which he refers as having been the scene of this demonstration, was provided with a vacuum system using some of the thermostatic traps now on the market. I should like Mr. Miller to give, if he has it, the amount of steam that passed through the traps in the form of steam when the system was operating under the conditions of vacuum in the radiators. If the test did not take account of that item, it merely demonstrated the possibility of temperature control in that way without counting the cost.

I do not know personally of a thermostatic trap which has a pressure-temperature control characteristic, close to that of the steam, to operate, even with a fair degree of efficiency, over such a wide range as would be required for temperature control, in an efficient manner, in the way suggested by Mr. Miller. I think some of the well-known manufacturers claim this flexibility to a certain extent, while others, equally well-known, say that it can't be done.

This idea is not new. In the days of the float trap it was practised right along, but since the advent of the thermostatic trap, it has not been practised much for the reason stated, i. e., the thermostatic trap was not believed to be different in operation at any pressure and temperature very far away from that at which it was sealed when manufactured. I believe if such temperature regulation was practicable without serious loss of steam at the low temperatures or serious water-logging at the higher temperatures, some of the vacuum heating people would have been doing it. They have generally advocated everything that was possible, and, sometimes, even more.

It appears from Mr. Miller's article that the pressure loss from the reducing valve through the steam lines to the radiators and through the returns back to the vacuum pump was 3 in. mercury and it would appear also that the combined length of the steam and return to the most distant radiator was about 800 ft. This small difference in pressure for a line of that length leads strongly to the conclusion that there was considerable leakage through the thermostatic traps, else this resistance would have been considerably greater.

The data on the steam leakage through the thermostatic traps during this test would be extremely valuable.

As to sizes of vacuum pumps on heating systems, which are not required to handle wastes of higher temperature than that from the heating system, I have used the following formula for a long time and never got a vacuum pump much "out of line."

Cubic inch pump displacement per minute equals 100 times the number of thermostatic traps, plus the number of square feet of direct radiation, or its equivalent, where other kinds of radiation are included.

The above formula will "catch" the installation of average tightness without automatic temperature control or packless radiator valves. The pump displacement must be increased, say, 50%, when automatic radiator control is used and may be decreased, say, 25%, when packless radiator valves are used. Allowance, of course, must be made for any unusual in leakage anticipated, as low-grade radiator valves, etc.

It would not be sufficient to handle the steam and vapor passing through the traps on a system working at the low temperatures suggested by Mr. Miller. Mr. Miller admits that the usual size vacuum pump installed is not sufficient to operate a plant under the low temperature he suggests in the radiators. The average vacuum pump probably operates under about 10 in. mercury. To handle the same air and condensation under 15 in. requires only about 25% more displacement, and with Mr. Miller's small differential (3 in.) there would be much less re-evaporation than in the usual vacuum system with about 12 in. differential.

Why, then, the large-size pumps suggested by Mr. Miller, unless to handle the increased amount of steam passing through the thermostatic traps?

H. C. RUSSELL.

Chattanooga, Tenn.

REPLY BY MR. MILLER

As stated in my previous letter, the vacuum heating tests referred to were not so extensive as could be desired, but they were complete enough to determine without much doubt that certain things could be expected of a vacuum heating system when operated as described.

Mr. Russell wishes to know the amount of steam passed by the radiator traps, and states that without these data the cost of operation was not counted. He also states that the thermostatic trap is not believed to be efficient in operation at any pressure and temperature very far from those at which it is sealed when manufactured.

I am sorry that the amount of steam passed by the traps can not be given, and therefore the efficiency of the traps, by themselves, is not known. I believe, however, it will be generally admitted that the important thing to be considered is the over-all efficiency of the heating system. In other words, the method by which any building can be properly warmed with the least amount of fuel is, other things being equal, the most efficient method of heating, regardless of the efficiency of individual parts of the system. Therefore Mr. Russell's comment as to "counting the cost" and efficiency of operation may be answered by the following data obtained during the test under discussion:

Date	Vacuum in steam main inches of mercury	Vacuum in return, inches of mercury
December 3.....	1	7
December 15....	18	21
December 16....	7	13

Date	Condensation in lbs. per hour	Average outside temperature 7 a. m. to 5 p. m., Deg. F.
December 3.....	10,740	27.3
December 15....	6,120	28.6
December 16....	8,460	27.2

This shows the difference in evaporation (under practically identical outside temperature conditions) with varying pressures in the steam main. On December 15, with the extremely high vacuum, the building was not properly heated. With an outside temperature of 28° or 29° F. the pressure on the steam main, for the building tested, should be around 10 in. vacuum, with 15 in. or 16 in. vacuum in the return. Operating at these pressures, there would still be a very substantial saving in evaporation over the usual method of operating with atmospheric pressure in the steam main and 8 in. or 10 in. vacuum in the return. Surely the owner of a building with as much hourly condensation as that above would rather forget the efficiency of the individual traps if he could effect so great a saving in evaporation.

Mr. Russell, in perfectly good faith, offers a formula for figuring the size of vacuum pumps. It illustrates better than anything else my previous statement about "mystic constants" in such formulae. Where does the "100 times————" come from? I know not.

In answer to the question raised in the last two paragraphs of Mr. Russell's letter, may I remind him that if we plot the displacement of any vacuum pump against vacuum produced, we do not obtain a straight line but a curve, in which the displacement per unit of time approaches infinity as we near a perfect vacuum, and so, even without any leakage or re-evaporation, we would need large-sized pumps to operate a vacuum heating system as indicated.

Tappings for Hot Water Storage Tanks

Whether the final proposals as to tappings for hot water storage tanks, recommended by the United States Department of Commerce, through its Bureau of Standards, is to meet the practical requirements of the industry, has already become a matter of varying opinions. This refers particularly to the smaller sizes of tanks, such as those used in residence work.

Fig. 1 shows the tappings originally proposed by the Department. After a series of conferences these were modified and the Department's final recommendations are shown in Fig. 2 which appeared in the *Plumbers' Trade Journal.*

A writer in the *Plumbers' Trade Journal,* L. I. Huntington, in discussing the final report, makes the point that there is a question about the tappings shown in Fig. 2 being quite suitable for all vertical tank installations. To illustrate his point he shows a small tank set vertical (Fig. 3), and raises the question as to how it can be connected, following the Department's recommendations, to secure as satisfactory results as are now being obtained from the types in common use.

He mentions, as one objection, the matter of blowing out the mud and sediment at the bottom, as there is no tapping provided in the bottom for that purpose. The only other practical way, he says, to remove that sediment is to have a handhole at the side of the tank near the bottom to permit cleaning by hand.

Furthermore, he adds, as a standard tank for vertical installations, there appear to be more tappings in the side and fewer in the top than are desirable. He then shows a sketch (Fig. 4) of a design for vertical installations which has the advantage of bottom blow-off, also an inner tube supply down through the top which he considers the best and safest way to arrange the cold water supply to a vertical hot water tank heated from a range. "The matter of connecting the cold supply to the boiler, shown in Fig. 3," he remarks, "would puzzle many a skilled plumber. Just where the trade would decide to connect it as a standard method we cannot even surmise. It certainly would not go down through the top with an inner tube, because that solitary tapping on top would have to be devoted to the hot water supply to the fixtures."

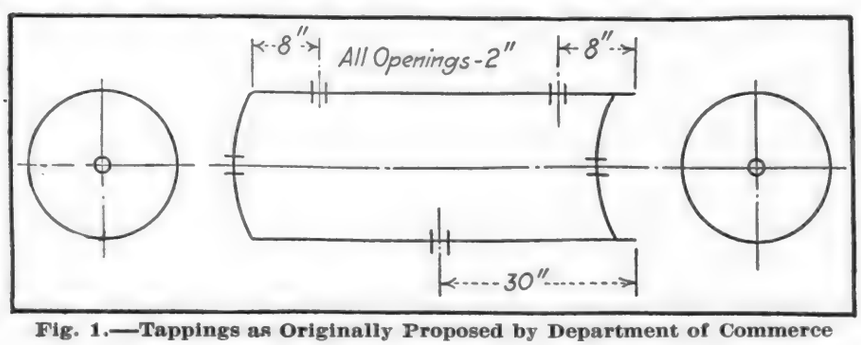


Fig. 1.—Tappings as Originally Proposed by Department of Commerce

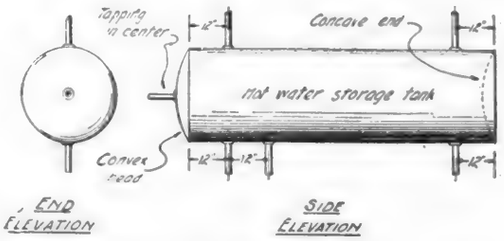


Fig. 2.—Tank Tappings as Finally Recommended by Division of Simplified Practice for Horizontal and Vertical Installations

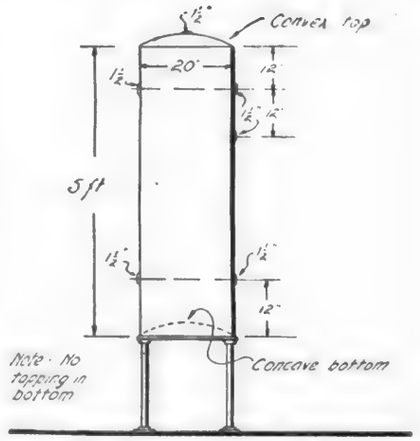


Fig. 3.—How the Proposed Tappings Would Apply to a Vertically Arranged Boiler

One of the side tappings, he suggests, would be used as a cold water supply, probably one of the lower tappings. Those experienced in such work, he declares, know that such a form of cold water supply to a vertical boiler is not desirable. He even characterizes it as dangerous, since the boiler could then be easily siphoned back to the mains, thus draining the water-back or hot water tank and possibly causing an explosion when the cold water flowed in again.

The American Construction Council has reached a stable basis in its service to the construction industry and its relation to the public, an announcement by Franklin D. Roosevelt, its president states. Definite lines of activity have been determined, consisting largely of conferences with representatives of the industry periodically to call attention to marked tendencies in construction activities.

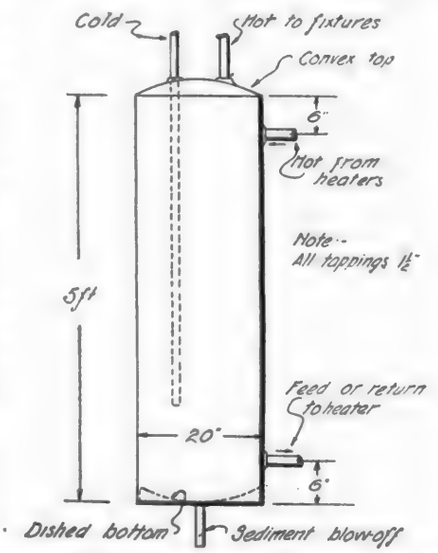


Fig. 4.—A Suggestive Arrangement of Tappings for Vertical Tanks

Effect of Over and Under Radiation Upon the Steam Consumption in a Building

Some data on a matter which has not been very closely investigated heretofore are furnished by J. E. Seiter of the Heat Utilization Committee of the National District Heating Association. The investigation deals with the effect of too much and too little radiation upon the steam consumption in a building.

As Mr. Seiter says, it has been apparent for some years that buildings known to have insufficient radiation have excessive steam consumption. Why this should be true as long as the heat losses from the building are the same was uncertain.

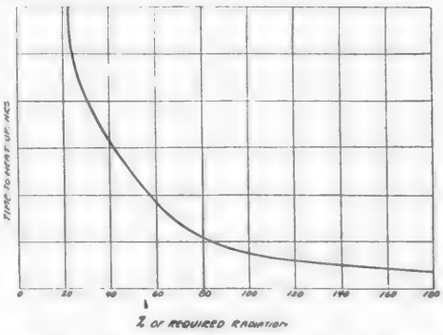


Fig. 1.—Time Required to Bring Building Up to Temperature with Various Percentages of Required Radiation

Mr. Seiter then told how, during the past heating season, one floor of a building used for test purposes was so equipped that the amount of radiation could be varied at will. The building was so operated as to maintain a temperature of 70° F. from 8:00 A.M. to 5:00 P. M. This was accomplished by turning off and on the steam at the main valve, thus simulating thermostatic control.

The steam was turned off at about 4:30 P. M., depending on the weather, and not on again in the morning until necessary to have the building up to temperature at 8:00 A.M.

The required radiation was computed by the method prescribed by the National District Heating Association. The building was maintained at the following percentages of this required radiation for periods of one day each throughout the heating season:

22.2%	112%
44.8%	134%
67.2%	151%
89.5%	179%

Half-hourly readings were taken of the inside and outside temperature, weights of condensate and steam presures.

RESULTS

The results indicated that during the period from 8:00 A. M. to 5:00 P. M., if the unutilized losses from the pipings are not considered, there was little difference in the steam consumption per hour, irrespective of the amount of radiation for the same outside temperature conditions.

The length of time necessary to bring the building up to temperature, however, was considerably greater with small amounts of radiation than with the required radiation. This length of time increased very rapidly as the radiation was decreased from that required and decreased very slowly as the radiation was increased from the required. This is shown graphically in Fig. 1.

This variation in the length of time to heat the building varied the total heat losses supplied by steam to a very marked extent. Figs. 2 and 3 shows a daily log of the temperature differences for twenty-four hours and may be taken to represent the heat losses from the building. The shaded area represents the heat losses during the period during which no heat was supplied to the building. From these charts it is easy to see the additional heat losses, during the period required to heat up in the morning. For comparisons the area inclosed in the heavy lines represents what these heat losses would have been had the building been properly radiated. It also is interesting to note how slowly the building cools down, being not more than 3° in one hour and averaging less than 2° with an outside temperature of 26° F.

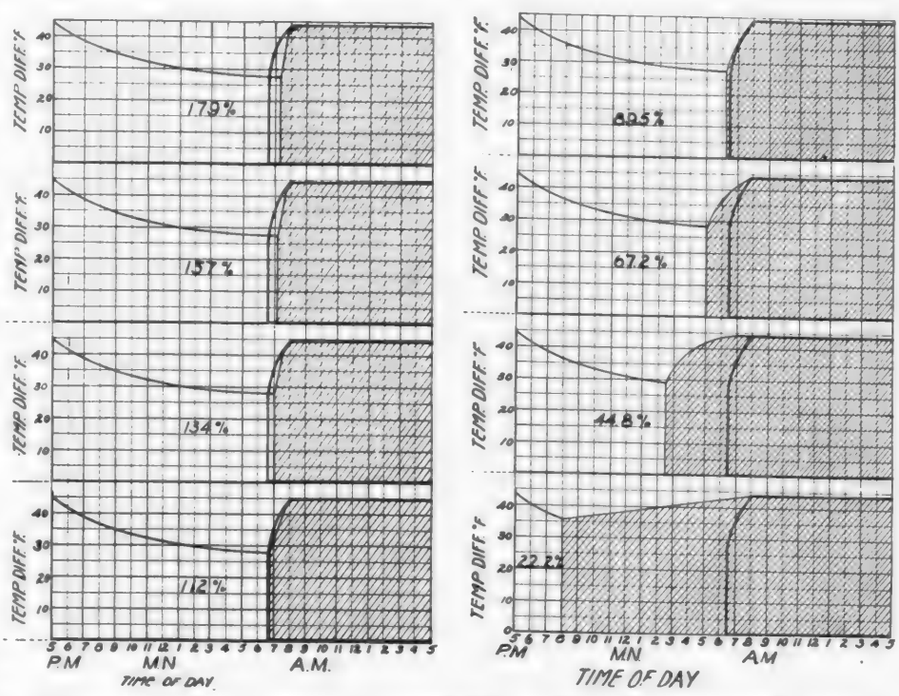
The variation in actual steam consumption for various outside temperatures for each percentage of required radiation under test is shown in Fig. 4.

These curves are not straight lines, as was expected, but turn rapidly in mild weather. This probably is due to the fact that little or no heat is required during the day in Spring and Fall, and, consequently, the length of time heat is supplied varies not only during "heating up" period but also during "cooling off" period, which starts earlier than 4:30 P. M., but still maintains 70° F. at 5:00 P. M. In other words, steam can be turned off at 2:00 P. M. during 60° F. weather, 3:00 P. M. during 50° F. weather, 4:00 P. M. during 40° F. weather, while during all other weather it was turned off at 4:30 P. M.

The percentage of steam consumption with over and under radiation is shown in Fig. 5. The saving by proper radiation is very evident, as under radiation causes excessive steam cost and over radiation creates excessive installation costs without sufficient steam saving to offset them. There is also the possibility that even with thermostatic control overheating might be experienced with too excessive radiation. This would result in open windows in mild weather, effecting additional loss.

Incidentally this test serves as a good check on the National District Heating Association method of computing radiation.

In conclusion, the savings possible by proper radiation are due to having steam turned off for maximum periods at night. This does not only apply to actual installed radiation, but to the effectiveness of radiation. Obstructed or air-bound radiation is not fully effective and is the source of great wastage of heat. The customary method of bronzing or aluminizing radiation reduces their effectiveness as much as 25%. (See Allen and Walker, page 53.)



Figs. 2-3.—Daily Logs of Temperature Differences Representing Heat Losses From the Building

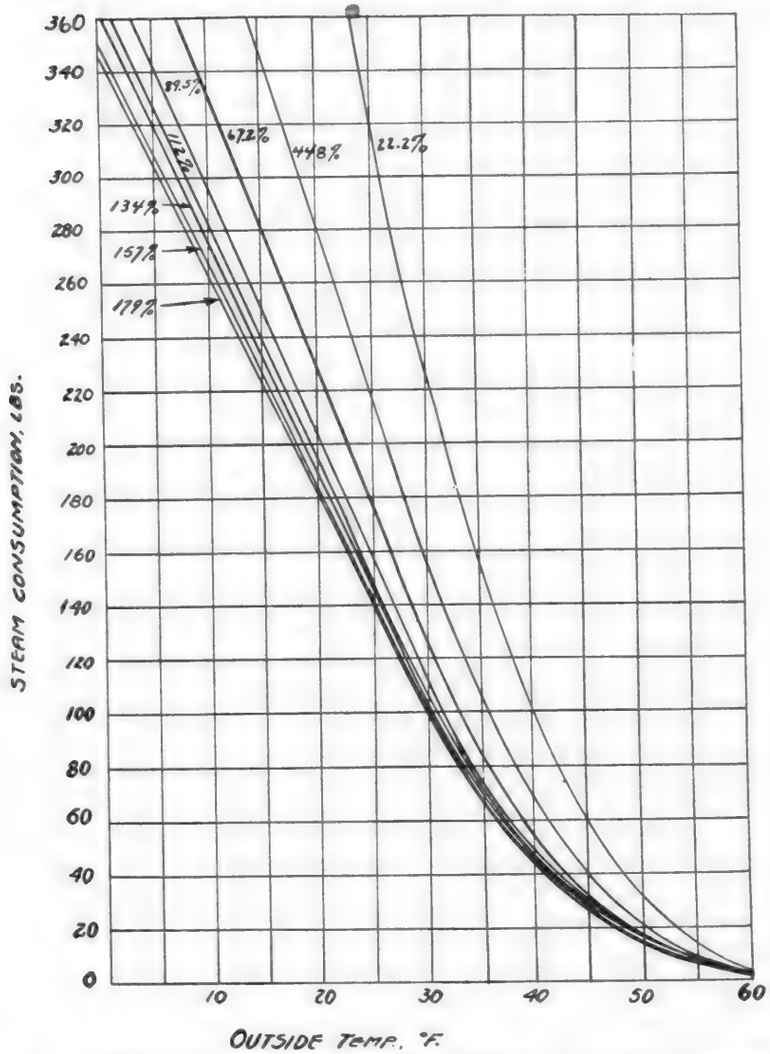


Fig. 4.—Variation in Actual Steam Consumption for Various Outside Temperatures for Each Percentage of Required Radiation

Poor circulation increases the length of time required to heat the radiators after steam is turned on and consequently creates a loss.

The Value of Insulating Hot Water Circulating Lines

It is common practice in certain sections to install circulating systems when automatic heaters are to be connected. This invariably results in an excessive operating cost, the service is frequently unsatisfactory and the water heater gets the blame.

On a circulating system hot water is continually passing from the heater through the pipes and back to the heater. The pipes really form a long radiator and each square foot of pipe surface radiates 150 B. T. U. per hour. 3½ lin. ft. of ¾-in. pipe have a surface equal to 1 sq. ft. Thus a circulating system only 35 ft. over all would radiate 1,500 B. T. U. per hour—equivalent in the case of a gas-heated water storage tank, to 3 cu. ft. of gas. This totals 2,150 cu. ft. of gas per month. With gas at $1.00 per 1000 cu. ft., this small system would waste more than $2.00 worth of gas per month.

Not only is the cost excessive, but the service is very likely to be poor. Unless the installation is made exactly right, water will flow through both lines when a faucet is opened, cold from the return line, hot from the flow line.

Instead of a circulating system, the hot water lines should run direct to the fixtures without return. The lines should be well covered. In the average home the first person up in the morning will fill the system with hot water, and if the lines are properly covered, there is only a 2° drop in temperature per hour. With water being drawn at frequent intervals, which is usually the case in most homes, one can easily see that the service will equal the circulating system, without any gas being wasted.

HEAT LOSS FROM UNCOVERED PIPES AND TANKS

A very interesting schedule showing the heat loss from uncovered pipes and tanks maintained at a temperature of 140° F. was recently published by a large gas company as follows:

Size of pipe: In. Diam.	Loss of B. T. U. every 30 days per 100 ft. of pipe:	Cubic feet of 535 B. T. U. gas at 74.7% efficiency necessary to replace heat loss:
½	2,296,000	5,700
¾	2,851,000	7,000
1	3,585,000	8,900
1–¼	4,514,000	11,300
1–½	5,191,000	12,900
2	6,497,000	16,200
Tanks: Gal.		
30	1,738,000	4,300
66	2,822,000	7,100
120	3,936,000	9,800
250	6,032,000	15,000
500	7,272,000	19,600

RADIATION LOSS FROM A SELF-CONTAINED STORAGE SYSTEM

With any self-contained storage system there are three places for the heat to go—into the water, through the jacket and up the stack. In a recent test of a self-contained storage system, comprising the Everhot automatic water heater, the regular insulation of a thick blanket of rock wool, placed between the inner and outer shells,

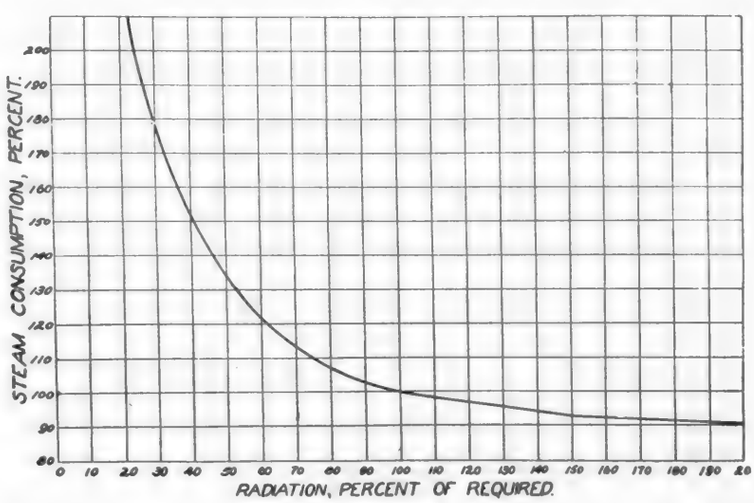


Fig. 5.—Percentage of Steam Consumption With Over and Under Radiation

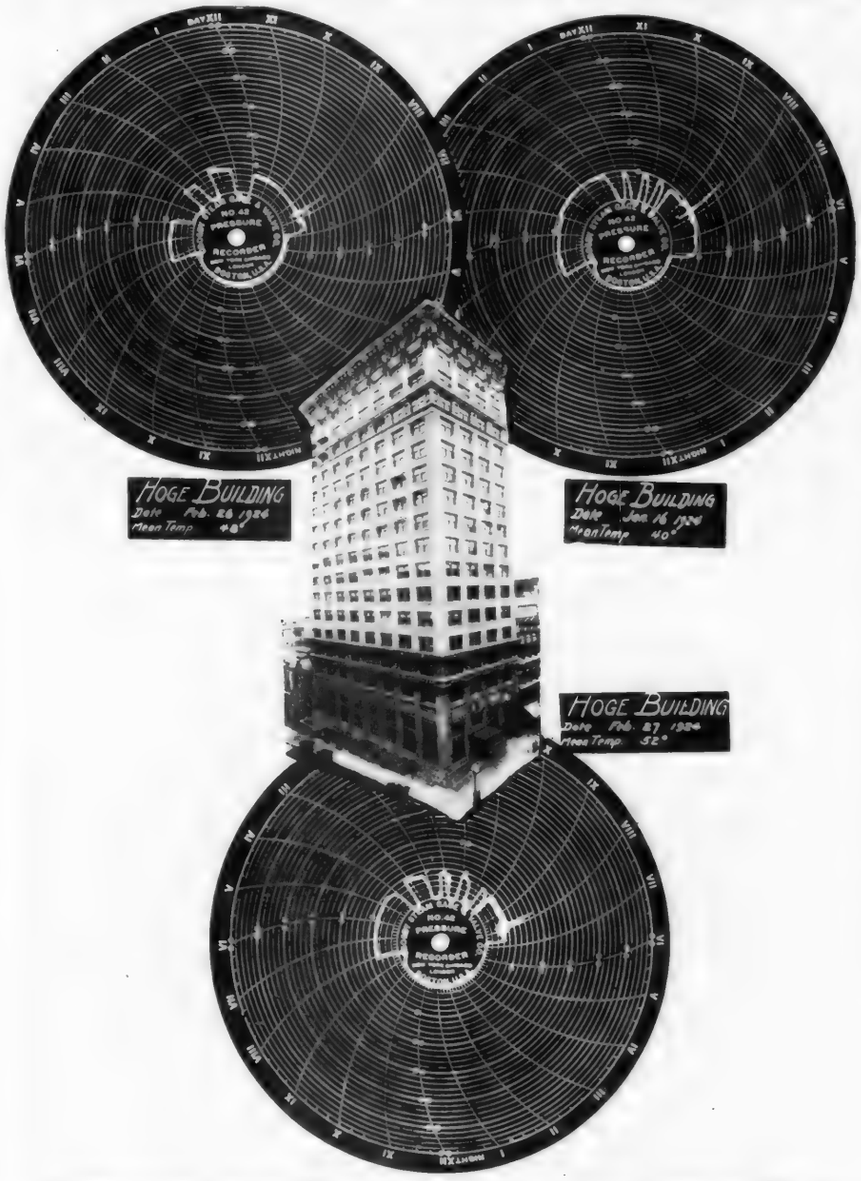
was supplemented by an additional insulated jacket, made up of 2 in. of hair felt, placed on a heater in operation to determine whether the regular insulation was giving satisfactory efficiency. It was found that the extra jacket made only a slight change, less than 10%. In the same connection the loss up the stack, taken from a recent heat balance test with an Everhot automatic water heater, showed a loss of less than 4%.

New Data on Steam Savings with Temperature Control

Possibilities in the way of steam savings with automatic temperature control are well known. As a rule, however, with the types actuated by clocks and electric motors, their use has been confined to smaller classes of buildings. Following recent experiments in utilizing these regulators in larger buildings, an installation of a unit-type thermostat was made in the 18-story Hoge Building, Seattle, Wash., which has produced some remarkable results.

The Hoge Building is heated by central station steam by the Northwestern Electric Co., of Portland. Full data as to radiation, type of system, estimated consumption, and consumption under manual control, are not yet available, but tests conducted by the heating company indicate a saving of approximately 26%. The installation of the regulator equipment, which is of the Minneapolis type, was made by William E. Worth, distributor for Seattle and Portland for the Minneapolis Heat Regulator Company.

On buildings of this size, the thermostat is used entirely as a limiting device, the idea being that with a room thermostat located in an office on the sixteenth floor, the management may be assured that its operation will shut off the steam flow in the street entrance as soon as the temperature of the room has reached 70° to 72° F. This arrangement makes it certain that the remainder of the building will be amply heated.



Temperature Control Tests in the Hoge Building, Seattle, Wash.

In addition to the economy thus effected, as this type of thermostat incorporates the eight-day clock feature, the lowering of the temperature at night and the raising of the temperature in the morning, with no attention necessary other than the weekly winding of the clock, provides an additional economy feature.

This method of temperature control, a full description of which appeared in THE HEATING AND VENTILATING MAGAZINE for September, 1923, was also the subject of a report of the Heat Utilization Committee of the National District Heating Association at its annual convention last June.

On the Hoge Building installation, the saving of 26% effected meant that the automatic control paid for itself within a few weeks from the date of installation.

Other notable savings reported by the Minneapolis Heat Regulator Company, through the use of its unit-type thermostat, are in connection with installations in Portland, Oregon, buildings including the Railway Exchange Building, the Broadway Building, and the Moose Temple.

Heating Contract for the Missouri Theatre Building, in St. Louis

In the advertisement of the Monarch Metal Products Company, which appeared in the August issue, giving details of the savings in the initial cost of the heating plant for the Missouri Theatre Building in St. Louis, made possible through the use of Monarch metal weather strips of the interlocking type, a typographical error made it appear that the James Black Masonry & Contracting Co., of St. Louis, was the heating contractor for this building. This company, it should be stated, was the general contractor. The heating equipment was installed by the Kupferle-Hicks Heating Co., of St. Louis. The original estimate, based on the air-change method, was $33,000, plus $1500 for equipping the windows with tongue-and-groove-type weather strips, making a total of $34,500. Figuring on the infiltration basis, the cost came to $30,000, plus $2300 for equipping the windows with Monarch interlocking-type metal weather strips, or a total cost of $32,300. This effected a net saving to the owner of $2200.

Michigan Chapter. A. S. H. & V. E.

New officers of the Michigan Chapter of the American Society of Heating and Ventilating Engineers are as follows:

President, J. B. Dill; vice-president, F. W. Johnson; treasurer, H. A. Hamlin; secretary, N. B. Hubbard. Board of governors: N. J. Hill, L. L. Smith and E. R. Little.

Important Government Decision on Separation of Contracts

A decision of wide interest to heating and ventilating engineers and contractors has just been announced by the Interdepartmental Board of Contracts and Adjustments, Bureau of the Budget, in Washington, to the effect that "no action be taken which would place any restrictions upon the authority of the heads of departments and independent establishments to exercise discretion as to the manner of awarding contracts or subdividing the work to be done." It will be recalled that during the past two years the Heating and Piping Contractors' National Asssociation, in conjunction with the National Association of Master Plumbers and the Electragists-International, have appealed to the Interdepartmental Board asking that in the interest of economy and improved building service, the various departments and bureaus be instructed to issue separate specifications and award separate contracts for the various branches of the mechanical equipment of public buildings.

Opposition to such instructions was expressed on the part of the general contractors by the Associated General Contractors of America. The board's decision, it will be noted, makes it possible for the bureaus to award separate contracts in their discretion, although the Board refuses the request of the heating, plumbing and electrical contractors. Following is the full text of the decision:

Whereas: A joint committee of the National Association of Master Plumbers and the Heating and Piping Contractors' National Association and the Association of Electragists—International, has requested the Interdepartmental Board of Contracts and Adjustments to take such action as will require the various departments and independent establishments of the Government, in connection with the performance of and contract separately, for portions of the work which pertain to their respective specialties; and

Whereas: This Board has taken this question under careful advisement and has heard the arguments of the above-mentioned associations, of the representatives of various departments and independent establishments of the Government and of numerous general contractors; and

Whereas: In view of the evidence produced, taken together with the experience of competent Government officials familiar with construction work, the Board believes that the granting of this request of the associations above mentioned would—

(a) Unduly restrict the freedom of action of the heads of departments;

(b) Be of doubtful value from the standpoint of actual economy in many, if not in the majority of, cases;

(c) Result in placing responsibilities and duties upon supervising Government officials which they are not always in a position to satisfactorily perform;

(d) Take away from the Government any advantage which it might otherwise secure from the utilization of a general contractor's organization and powers of properly timing and co-ordinating the various parts of the work; and

(e) Tend to delay the performance, give rise to claims for delays of one contractor by another, and create difficulties which are largely avoided when the work is performed under one contract;

Therefore it is

Resolved: That it is the opinion of the Board that it is to the interest of the United States that no action be taken which would place any restrictions upon the authority of the heads of departments and independent establishments to exercise discretion as to the manner of awarding contracts or subdividing the work to be done;

Be it further

Resolved: That the question of the advisability of subdividing contracts in specific cases be called to the attention of contracting officers in the manual of instructions now being prepared by the Board.

Commenting upon the decision, a writer in the *Official Bulletin* of the Heating and Piping Contractors' National Association for August, says:

"Our members should study carefully the reasons assigned by the Interdepartmental Board for not giving the more inclusive instructions requested. The first one, of hesitating to restrict the freedom of action of heads of departments, is an old familiar one. Governing boards are prone to guard this freedom of executive action jealously. This, however, constitutes no serious obstacle as when the government officials are convinced that the other objections are removed, this will automatically disappear.

"The second reason is one to which we must make vigorous objection. The board says that it would 'be of doubtful value from the standpoint of actual economy in many, if not in the majority of, cases.' Our contention has been, and still is, that the separation of the mechanical equipment results in real economy. It results in an actual saving of money expended. It results in a further real economy in the installation of mechanical equipment fitted to the needs of the building which will actually fulfill those needs.

"The first saving may not be so important to a wealthy private owner or a stable, well-supported government. The second saving, however, is always a prime consideration. The mechanical equipment of a building is its heart and life. One cannot obtain too much skill or responsibility in the contractors making these vital installations.

"This skill and responsibility is often lacking in the sub-contractor who is obtained by the 'shopping' methods so common in the field of general contracting. The undesirable results of this are discovered after the building is occupied and the equipment fails to function to the best advantage.

"The third 'reason' seems rather an excuse than a reason. Especially is this true if the contention of the general contractor, that his employment insures two inspections, is to be accepted at face value. However, we feel that our Government officials are more capable than the paragraph would indicate. Certainly one capable of inspecting mechanical equipment as installed under the direction of a general contractor would be just as capable of such an inspection if dealing directly with the work of a contractor for that equipment without the intervention of the third party.

"The fear that the Government might lose an advantage arising 'from the utilization of a general contractor's organization and powers of properly timing and coordinating the various parts of the work' and the last reason that it might 'tend to delay the performance, give rise to claims for delays of one contractor by another, and create difficulties which are largely avoided when the work is performed under one contract,' brings us to the crux of the question and causes us to face squarely the query—what does a general contractor have to furnish to the government in connection with the installation of mechanical equipment.

"It would seem that the general contractor is proposing a place for himself which requires him to appear in dual roles.

"He claims to represent the owner in the purchase of commodities and services and in managing the operations as they develop in practice. At the same time he is a vendor, reselling to the owner those things which he buys as well as the services which he and his organization may furnish.

"Under the *cost plus system* one can see how such a condition might be proper.

"Under the *fixed price system*, followed exclusively by the Government in times of peace, it is a difficult mental feat for one to reconcile the conflicting interests of the purchasing agent and manager with that of vendor.

"Unless human nature has changed greatly in the past few months we believe that the general contractor, with due thought for his own interests as the most important to him, is acting primarily as a vendor and purchasing material and labor and reselling them in such a way as to produce a maximum of profit for himself on a minimum of invested capital. This supposition is brought closer to belief when one considers that the general contractor buys at least 70% of what he sells.

"This very fact—that the general contractor is a merchant selling for

profit—is responsible for the many annoyances and injustices which have caused upstanding, skillful, responsible heating contractors to insist on selling their services direct to the owner rather than to deal with a third party.

"Unless the entire structure of the building industry is changed so that the general contractor can function in some other way than as a reseller of the productive work of others we feel sure that the responsible heating contractors will continue to insist on dealing directly with the owner and we shall continue to work for that end.

"The heating and ventilating of any building is of such vital importance that it should not be made subservient to the interests of a third party who adds neither material nor service to it. The introduction of the third party serves only to increase the 'spread' between manufacturing costs and the cost to the owner. This is unnecessary and works to the detriment of the entire building industry. It is directly opposed to the principles of eliminating waste in industry for which Herbert Hoover is working so earnestly and efficiently."

District Heating Report Completed for Dominion Fuel Board

The investigation on the subject of district and central heating, upon which F. A. Combe, consulting engineer of Montreal, Canada, has been engaged during the past year for the Dominion Fuel Board of the Canadian Government, has now been completed and the report will shortly be published. This represents one phase of the work of the Dominion Fuel Board in studying the fuel situation in Canada.

The report will make known the present status of district heating, especially in the United States, and deal with the possibilities of its greater application in Canada. General information will be given for the guidance of municipalities and other bodies which may be interested in the subject and it is hoped that it will lead to more extensive use of central methods of heating for groups of buildings, for sections of cities where the conditions are suitable.

Very complete studies have been made of a large number of district heating utilities, and the factors governing successful operation have been analyzed and general conclusions drawn.

The large amount of hydro-electric power available in certain sections of the Dominion where there is a scarcity of native coal make for very interesting and advantageous possibilities in the co-ordination of water and fuel power for central steam and heating service, and the matter contained in the report should be of considerable value to engineers.

The Customer and His Coal Pile

By Thomas D. Casserly

Mechanical Engineer, Weil-McLain Co.

A HEATING contractor's duty to his customer is not fulfilled after he has tested out the heating plant, started a fire and collected his money. It is not only good business but it is part of the service that the heating contractor owes to his customer to instruct him in all of the little details that will save fuel and extract the greatest amount of heating comfort from every dollar's worth of fuel that is burned. The writer has often heard enthusiastic salesmen and contractors assure a prospective customer that after his boiler is installed all that is necessary is to light a match, put in the fuel, look at the boiler night and morning, and all of his heating problems will be solved. Automobile salesmen have made similar alluring statements. The man who expects to drive a car 50,000 miles and do nothing but put in water, oil, and gas is due for a sad awakening.

A few minutes each day in giving a little additional attention to the heating boiler will pay big returns in the fuel saved and the additional comfort resulting from the proper operation of the heating plant.

All boiler manufacturers recommend cleaning the flues daily, but from personal observation of the writer not one person in ten will take the trouble to brush the soot and ash from the flue surfaces until they are so badly coated that the gases are choked in the passages. The boiler manufacturer spends money to put extra heating surface in the boiler so that the home owner can get all of the heat available from the fuel. The man who buys the boiler pays for the added surface and then neglects to take advantage of the saving features that he has paid for, by neglecting to keep the flue surfaces clean.

Soot acts as an insulator and will not let the heat of the gases be transferred to the water in the boiler. Experiments have proven that ⅛-in. of soot will reduce the efficiency of the heating surface 30%. The average boiler attendant does not consider the flues as dirty if only ⅛-in. is the thickness of the blanket on the flues. It is safe to say that the average loss in efficiency due to soot covered heating surfaces is 40%.

GREASE AND DIRT IN THE WATER

Another cause of fuel waste is due to oil and grease that accumulate on the surface of the water in the boiler. The best demonstration of this condition is to place two pans containing equal quantities of water over two gas burners of equal size. Have the water in one pan perfectly clean, and in the other pour a tablespoon of grease. Note how much quicker the clean water will evaporate, and the difference in the surface action of the water in the two pans. This same condition exists in a steam boiler. For economical operation the water must be evaporated with the least amount of fuel and pass into the piping system and radiators in the form of steam. If the water is covered with a film of grease, more fuel must be burned to generate steam that can flow to the radiators and perform the function for which it is being evaporated. Recent tests conducted on a boiler of popular size and make showed that 14% more water was evaporated for the same amount of fuel burned after the boiler had been cleaned than had been evaporated when the boiler contained the oil and grease from a short run of pipe. On large installations this percentage will be increased.

REGULATION AT THE BOILER

A runaway fire is hard to control and the dampers on either a steam or water boiler should be controlled by an automatic regulator, set so that the regulator action is close enough to prevent the fire from running away, or getting too low. It is very wasteful to let steam boilers blow off at the pop valve or hot water systems to overflow at the expansion tank. Valuable heat units are thus thrown away.

It is just as bad to let the fire die down too much as it is to let it run away. The fire-pot should be kept full at all times and in mild weather let the ash accumulate in the grate. Anticipate any sudden drop in temperature by setting the regulator to control fire for colder weather.

The regulator should be set so that the pressure or water temperature will not run higher or lower than a certain point. The weather condition will be the deciding factor as to the pressure or temperature to be carried. In the case of a steam boiler 2 lbs. is ample to heat any building, and the regulator should be set so that pressure will not drop below 1 lb. or rise higher than 3 lbs. In the case of a water boiler the temperature range should not be greater than 10°.

Steam Service Control Through Intermittent Supply

Overheating of American homes and other buildings is only too well known. In no field is this so much appreciated as among the central station heating companies as they are always in a position to check excessive consumption in a given installation, due to the fact that usually either the steam supply or the condensation is metered.

In addition to thermostatic control, the heating utility companies have long been seeking a means of overcoming such difficulties as the opening of windows in warm rooms which, of course, defeats the desired operation of any system of thermostatic control.

One of the latest methods to be developed is the subject of a paper by William J. Baldwin, Jr., presented at the recent convention of the National District Heating Association. This method is a steam service control equipment designed by F. E. Pendleton and which has been used with success by the New York Steam Corporation.

As Mr. Baldwin states in his paper, "the radiation in a building is designed to meet unusual low outdoor temperature conditions (zero in New York). The result is that when the outdoor temperature is above zero, as it is most of the winter, averaging as high as 30° in the coldest months, January and February, and 44° in November and 48° in April, most buildings become overheated. We know the results that have been obtained by different systems of steam and vapor temperature control or regulation and what the objections are to them, as well as their merits.

"It is hardly necessary to say a distinct need exists for some means other than the systems of temperature regulation that can be applied at small expense and which is reasonably simple in design and easy of operation to control the amount of steam admitted to the heating system of a building. This is particularly so where steam is supplied from central station plants.

"Few will question that it is economically sound to co-operate to the utmost with consumers along the lines of reducing the quantity of steam used.

"Where steam is sold at a sliding scale, any steam saved at the low-step prices can be sold at a higher-step price to other consumers. This is only one reason why the utility company is justified in taking any reasonable steps to reduce the consumer's steam consumption to a justifiable minimum.

"Where central station service is utilized, close control has been made possible without limiting the ultimate capacity of the steam heating system in extreme weather and yet placing within the hands of the operator the means of reducing the supply to a minimum if so desired. It is not temperature regulation but steam control at almost any point from a minimum to the limit range of the plant changeable at the will of the operator at a moment's notice.

"By automatically regulating the periods of time and the duration thereof during which steam is supplied to a heating system, it is possible within certain limits to control the amount of steam used to more satisfactorily meet the varying demands for heat at various times, morning, afternoon, evening or late at night. This is not temperature regulation to maintain fixed indoor temperatures but rather an adjustable automatic control device to turn on and shut off steam with a minimum of effort on the part of the person in control of the heating equipment. During the regular off periods the steam radiators may never become actually cold to the touch.

"A steam service control equipment which was devised some years ago by F. E. Pendleton but which was not exhibited or placed on a production basis until the early part of last year, is the most advanced thing in steam control that the writer knows of. It has been demonstrated by actual results during the past winter that the quantity of steam used for heating under like weather conditions can be greatly reduced. The saving produced is steam that was used unnecessarily due to lack of any practical means of preventing it.

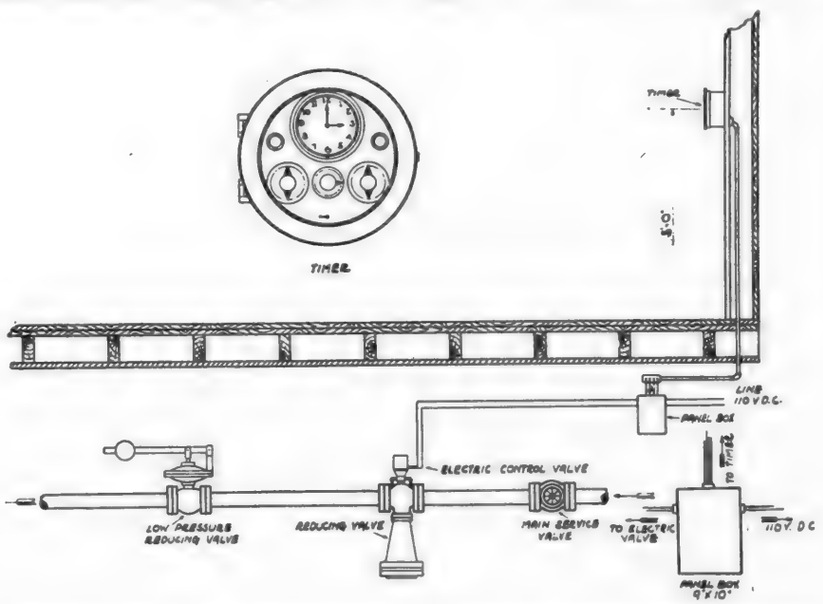
"The Pendleton control equipment that has been placed in operation in a number of apartment houses, hotels and office buildings in New York is not intended to maintain a constant temperature within the building at all times but provides an amount of steam suitable to the conditions as desired by the operator. In the same fashion that the clock on the usual form of house thermostat may be so set as to shut off the service at night when steam is not required and to again turn on the steam in the morning, the service control can be regulated by the operator at will.

"The equipment provides an intermittent supply of steam to the radiation either throughout the twenty-four hours of the day or during the daytime hours only. The setting of a day switch may provide no service, or "Steam Off," continuous service, or "Steam On" for the twenty-four hours of the day; or may provide five intermediate settings such that during each period of 90 minutes steam will be supplied in increments of 15 minutes for each successive setting of the switch, with the steam shut off during the balance of the 90-minute period, namely—¼ hr. on, 1¼ hr. off; ¼ hr. on, ½ hr. off; ¼ hr. on, ¼ hr. off; ½ hr. on, ¼ hr. off; 1¼ hr. on, ¼ hr. off; and thus affording 16⅔%—33⅓%—50%—66⅔% and 83⅓% of that maximum heating effect that is only required on days of zero temperature.

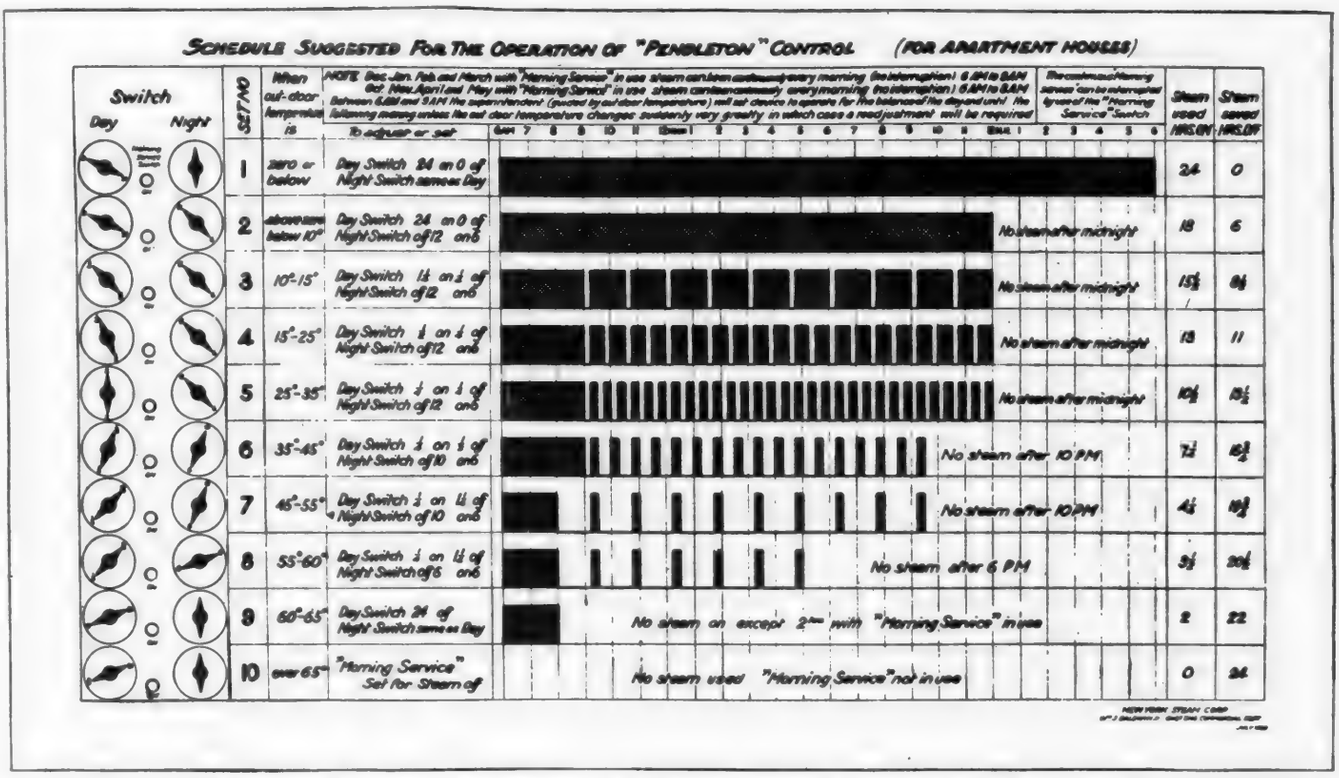
"A night switch is provided with a variety of settings and which may be so adjusted as to maintain throughout the night the intermittent supply as provided by the day switch, or may be adjusted to interrupt the operation of the day switch and entirely cut off the supply of steam to the radiation at night during certain hours as selected.

"A third switch is also provided that when thrown in service will operate independently of the day and night switches to supply a full service of steam to the radiation during the hours from 6:00 A. M. to 9:00 A. M. to afford an excess of heating when desired by the operator.

"The operation of the equipment is to interrupt the normal steam supply. Any failure of electric circuit for any reason permits steam to flow to the radiation, the same as though the

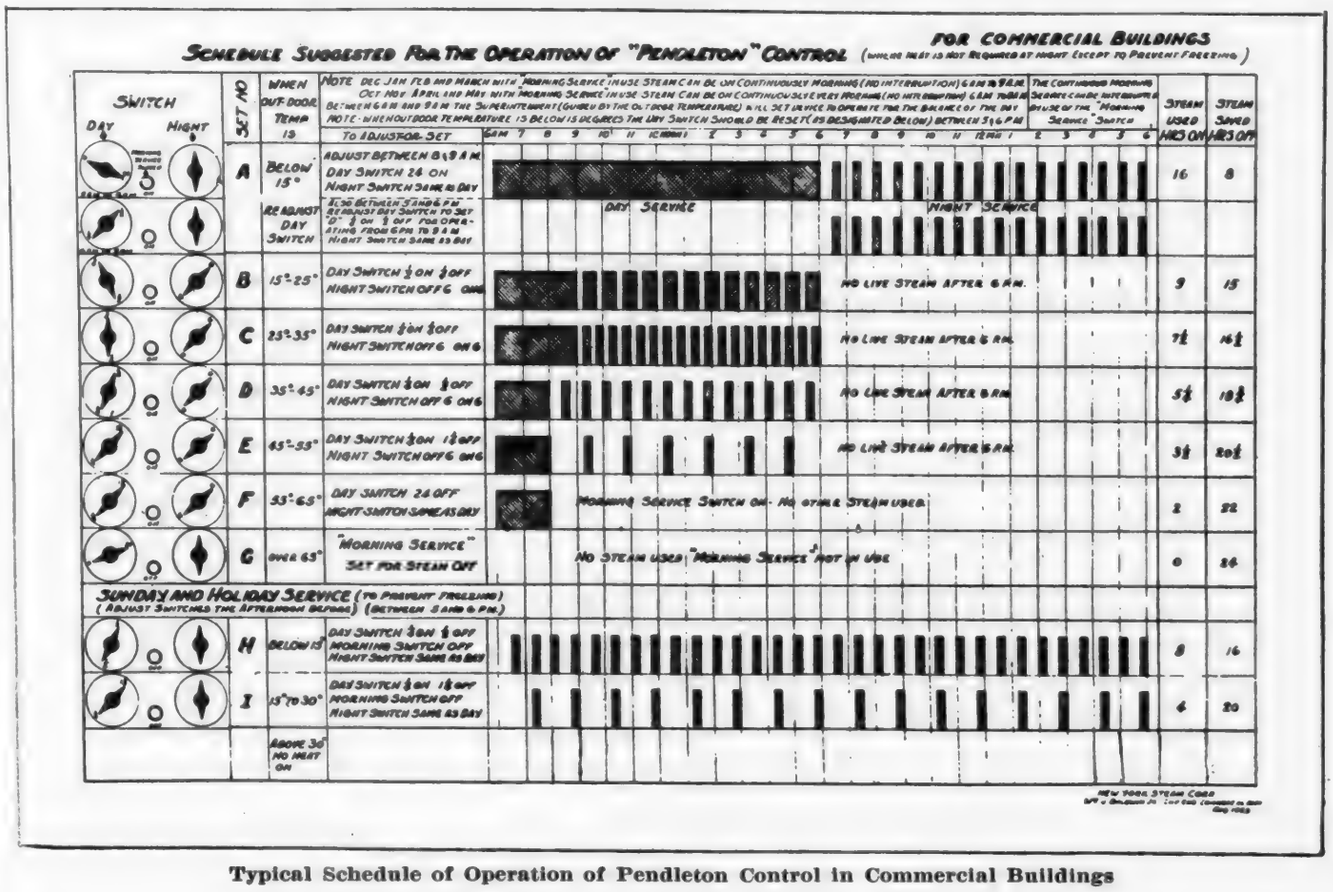


General Installation Arrangement of Pendleton Steam Service Control


SCHEDULE SUGGESTED FOR THE OPERATION OF "PENDLETON" CONTROL (FOR APARTMENT HOUSES)
Switch
Day
Night
SET NO
When out-door temperature is
To adjust or set
Steam used HRS ON
Steam saved HRS OFF
1 zero or below Day Switch 24 on 0 of Night Switch same as Day 24 0
2 above zero below 10° Day Switch 24 on 0 of Night Switch off 12 on 6 No steam after midnight 18 6
3 10°-15° Day Switch 12 on 1 off Night Switch off 12 on 6 No steam after midnight 15½ 8½
4 15°-25° Day Switch ½ on 1 off Night Switch off 12 on 6 No steam after midnight 13 11
5 25°-35° Day Switch ½ on 1 off Night Switch off 12 on 6 No steam after midnight 10½ 13½
6 35°-45° Day Switch ½ on 1 off Night Switch off 10 on 6 No steam after 10 PM 7½ 16½
7 45°-55° Day Switch ½ on 11 off Night Switch off 10 on 6 No steam after 10 PM 4½ 19½
8 55°-60° Day Switch 1 on 11 off Night Switch off 6 on 6 No steam after 6 PM 3½ 20½
9 60°-65° Day Switch 24 off Night Switch same as Day No steam on except 2nd with "Morning Service" in use 2 22
10 over 65° "Morning Service" Set for Steam off No steam used "Morning Service" not in use 0 24

Typical Schedule of Operation of Pendleton Control in Apartment Buildings

equipment were not installed. Completion of 12-volt circuit at timer closes relay switch in panel box which closes 110-volt circuit to solenoid pilot valve, which opens same and admits high-pressure steam to diaphragm chamber of service reducing valve, and shuts off the supply to the building. Closure of relay switch also produces through auxiliary contact, a closure of 12-volt circuit to green jewel lamp in timer, indicating 'Steam Off'. Breaking of 12-volt circuit at timer opens relay switch in panel box, permits the spring-loaded solenoid pilot valve to close, shuts off high pressure from diaphragm chamber, permitting service reducing valve to open and resume delivery of steam


SCHEDULE SUGGESTED FOR THE OPERATION OF "PENDLETON" CONTROL FOR COMMERCIAL BUILDINGS
SWITCH
DAY
NIGHT
SET NO
WHEN OUT DOOR TEMP IS
To Adjust or Set
Steam used HRS ON
Steam saved HRS OFF
A Below 15° ADJUST BETWEEN 6 & 9 A.M. DAY SWITCH 24 ON NIGHT SWITCH SAME AS DAY DAY SERVICE NIGHT SERVICE 16 8
RE ADJUST DAY SWITCH
B 15°-25° DAY SWITCH ½ ON ½ OFF NIGHT SWITCH OFF 6 ON 6 NO LIVE STEAM AFTER 6 A.M. 9 15
C 25°-35° DAY SWITCH ½ ON ½ OFF NIGHT SWITCH OFF 6 ON 6 NO LIVE STEAM AFTER 6 A.M. 7½ 16½
D 35°-45° DAY SWITCH ½ ON ½ OFF NIGHT SWITCH OFF 6 ON 6 NO LIVE STEAM AFTER 6 A.M. 5½ 18½
E 45°-55° DAY SWITCH ½ ON 1½ OFF NIGHT SWITCH OFF 6 ON 6 NO LIVE STEAM AFTER 6 A.M. 3½ 20½
F 55°-65° DAY SWITCH 24 OFF NIGHT SWITCH SAME AS DAY MORNING SERVICE SWITCH ON - NO OTHER STEAM USED 2 22
G OVER 65° "MORNING SERVICE" SET FOR STEAM OFF NO STEAM USED "MORNING SERVICE" NOT IN USE 0 24
SUNDAY AND HOLIDAY SERVICE (TO PREVENT FREEZING) (ADJUST SWITCHES THE AFTERNOON BEFORE) (BETWEEN 3 AM & 6 PM.)
H BELOW 15° DAY SWITCH ½ ON ½ OFF MORNING SWITCH OFF NIGHT SWITCH SAME AS DAY 8 16
I 15° TO 30° DAY SWITCH ½ ON 1½ OFF MORNING SWITCH OFF NIGHT SWITCH SAME AS DAY 4 20
ABOVE 30° NO HEAT ON

Typical Schedule of Operation of Pendleton Control in Commercial Buildings

to radiation. The opening of relay switch breaks auxiliary circuit to green jewel lamp and closes auxiliary circuit to red jewel lamp in timer, indicating 'Steam On.'

"Maintenance of the equipment is practically nil, as there are no continuously moving parts, other than the clock and no adjustments or lubrication required.

"Operating charts or schedules have been developed by the writer, which are furnished to the consumer as a suggested basis of operation, showing for various ranges of atmospheric temperatures: the settings of the various switches that may be found by the operator to furnish sufficient steam to the radiation during the day, at night, and during the early morning, that will approximately meet the requirement of an excess steam supply during the early morning, a lesser supply during the day and depending upon the occupancy of the building, and weather conditions, and a minimum supply during the night, and in order to secure the greatest economy in the use of steam. It has been found that the suggested schedules have afforded satisfactory operating conditions in the building and have produced most substantial economies from the use of steam, in fact in many cases, even less quantity of steam has been delivered to the radiation than recommended by the chart, with proportionate increase of economy in the cost of service.

"A schedule compiled from a theoretical heat loss curve will undoubtedly fall short of actual requirements in most buildings, and therefore in compiling the schedules arbitrary ranges of temperatures had to be fixed to make the schedule flexible.

"Results that have been obtained are most gratifying both to the company and to the consumer, and the convenience afforded the consumer in the operation of the heating equipment has been fully appreciated."

TYPICAL SAVINGS EFFECTED BY STEAM SERVICE CONTROL

A few illustrations of the saving secured indicative of the value of this equipment are included in the paper and are here given.

ESSEX HOTEL—3,471,000 lbs. of steam used in three months last season without control as compared with 2,651,000 lbs. for the same period this season with control. Without the control the consumption was 30% higher.

SAN JACINTO HOTEL—2,497,000 lbs. of steam used in four months last season without control as compared with 1,904,000 lbs. for the same period this season with control. Without the control the consumption was 31% higher.

PEASE & ELLIMAN Apartment House, 535 Park Avenue—5,807,000 lbs. of steam used in three months last season without control as compared with 4,631,000 lbs. for the same period this season with control. Without the control the consumption was 25% higher.

A more comprehensive illustration of the results is obtained from the fact that in approximately twenty-five buildings where the service control equipment has been in operation for from three to five months during the past heating season, the total amount of steam supplied to these buildings this season with the control equipment operating was 85,000,000 lbs. as compared with 103,000,000 lbs. used last season in the same buildings for the same period of time under practically the same outdoor temperature conditions. This shows that without the control equipment the steam consumption was 20 6-10% greater than with the control equipment.

Expansion of the New York Steam Corporation

An offer of 11,000 shares, preferred stock, Series A, of the New York Steam Corporation, which has just been made by the National City Co., New York, marks an interesting step in the progress of central station heating, as well as in the growth of this corporation. Accompanying the notice of the offering is an attractively-compiled folder devoted to the New York Steam Corporation which gives evidence of the important place the central heating industry has gained in the eyes of the financial world.

"With its expansion into new territory between 35th Street and 47th Street," states the circular, "the New York Steam Corporation will serve two of the most favorable districts for supplying steam in the United States, i. e., the downtown financial district of New York City, with its many high buildings and narrow streets and the important commercial and residential section extending from 36th Street to 79th Street."

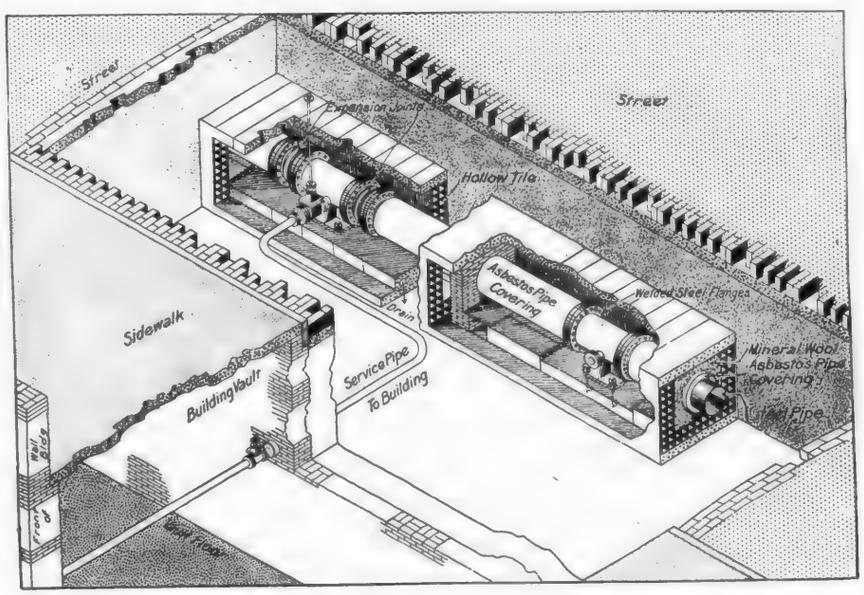
A number of buildings, adds the circular, for which the New York Steam Corporation has contracted to supply steam are being constructed without boiler equipment and, in some cases, without smoke stacks.

Through the co-operation of the New York Edison Company, the distributing system of the New York Steam Corporation is now being connected with the large Edison Waterside Power Stations, thus allowing greater flexibility of operation and permitting the corporation to connect many large buildings in the Forty-second street district.

Through a subsidiary company the corporation has acquired a large tract of land on the water front just south of the Waterside Stations, upon which it proposes to erect a large additional steam station.

The folder lays emphasis on what it terms "the very favorable rate structure under which charges for steam made by the corporation increase or decrease monthly with the cost of coal, and points out that this provides an assurance that the earnings will be satisfactory. Under actual operation of this plan during the past six years, it is stated, this tariff has resulted in a constant reduction in the cost of steam. In 1921 the average rate charged was $1.20, whereas for the last twelve months' period, the average rate was 96 cents per 1000 lbs. of steam. During the same period the earnings of the corporation increased 50%.

The tunnels or conduits in which the mains and distribution system of the corporation are laid consist of a reinforced concrete base, hollow tile walls, and a concrete roof slab. Over 90% of the steel-pipe distribution, it is stated, has forge-welded steel flanges. The corporation has developed its own type of expansion joint. The steam pipes are covered with thick asbestos lagging which, in turn, is surrounded by mineral wool, completely filling the tunnel.



Typical Construction Detail of Underground Distribution System of New York Steam Corporation

New Trade Publications

METERING RADIATOR BUSHING, a device now manufacturered by the Holley Engineering Co., Virginia, Minn., for supplying radiators with the correct amount of steam and which directs the steam into the first radiator section, is described in a well-prepared circular, issued in the form of a three-letter file. The principle of the bushing, which the manufacturers have tested for two winters in Minnesota where its factory is located, is that of the fixed aperture or orifice. In this application it is combined with a device to turn the steam, as it enters the radiator, into the large volume of the first section of the radiator. The manufacturers state the bushing has given full satisfaction in temperatures as low as —30° F. Concerning the bushing, the Holley circular letter states: "It is quite evident that with a fixed aperture placed at steam entrance to the radiator, no outside condition, such as exposure to cold wind, will affect the amount of steam passing into the radiator. This has a particular appeal to owners or operators of all buildings where rooms are rented heated. In addition to not being affected by windows left open, it is also a simple matter to reduce the temperature of the entire building during unoccupied hours." Another feature pointed out by the company is the fact that by centralizing the control of steam to the entire building, the responsibility for properly regulating the pressure to suit the weather needs can be fixed readily. The use of the bushing, it is stated, requires no special layout of the heating system and it can be used, with slight modifications, on a vacuum system.

Some interesting figures on the use of this metering bushing in four Minnesota hotels were given in the report on the subject of "fixed orifices," by the Utilization Committee of the National District Heating Association:

"The steam used by the Fay Hotel, Virginia, Minn., both before and after the metering bushings were installed, is compared to that used by several hotels similarly located. All of the hotels considered are heated with steam purchased from the municipal heating plant. All of the meters are carefully inspected three times each month. This inspection includes reading of meter and comparing same with previous readings and making adjustments due to stopped meter where same is necessary.

"During November, 1922, metering radiator bushings were installed in all radiators of the Fay Hotel, the steam and return lines were covered with 85% magnesia, replacing old air-cell covering. Some corrections were also made in the mains and returns. The radiators, with the exception of two, are of the steam type. By the use of the metering radiator bushings the returns from the radiators are of room temperature. The return water is not any warmer than it would be if all of this radiation had been replaced with the hot-water type. The steam consumption records amply bear out our claim that in addition to saving the cost of new radiation these bushings also provide an economy, due to centralized regulation, which in itself is sufficient justification for their adoption.

"The following records have been taken from the meter ledger of the Water & Light Dept., Virginia. These readings have been checked and verified by Mr. Pruett, superintendent.

Note: Due to the addition of a new annex to the Fay Hotel, which was first heated in January last, the readings for that month are comparable.

"Each of the last three hotels used either close to the same amount or more steam in 1922 and 1923, while the Fay Hotel, equipped with the meter radiator bushings, showed a saving from the time of the installation. In 1922, with but a short period for comparison, this saving is already evident, while in 1823 it shows definitely as 36% of the steam used. The saving in the use of steam is made possible by the centralized regulation. By simply changing the pressure at the reducing valve the amount of steam which goes to each radiator is proportionately increased or reduced.

"As a confirmation of the results obtained at the Fay Hotel we are able to submit meter readings taken from the records of the Minnesota Power and Light Co., of Eveleth, Minnesota, and covering the steam used during the months of November, December, and January, or the same three years by the Rex Hotel of Eveleth, Minnesota. During October, 1923, this hotel was equipped with metering radiator bushings. The plant was a single-pipe installation with steam-type radiators. Return lines were installed and all radiators equipped with metering bushings.

Steam used is given in thousands of pounds

	Rex Hotel, Eveleth		
	1921	1922	1923
Nov.	150	97	106
Dec.	170	234	106
Jan.	161	150	165
Totals.	481	481	394
	100%	100%	82%

"The meter records as given for the three Virginia hotels not equipped with metering bushings show an average percentage comparison for the same three months of:

1921 to 1923 103%
1922 to 1923 105%

"This confirms the more thoroughly established saving at the Fay Hotel. The shorter-test period of the Rex Hotel might by itself not mean a great deal but, when used to substantiate the savings at the Fay, it supports fully the confidence placed in this simple device as a steam saver."

AUTOMATIC CONTROL OF COMBUSTION AND SYSTEMS FOR AUTOMATIC CONTROL OF COMBUSTION are presented in Bulletin M and Catalog No. 99, bound together and issued by the Carrick Engineering Co., 538 South Clark St., Chicago, Ill. In the catalog an extended discussion is given of automatic control methods and systems, bringing out the limitations of the various systems and why they sometimes fail. It analyzes the conditions to be met in co-ordinating supply of steam with the demand and gives some interesting charts of steam pressures. What the company terms the fallacy of close steam regulation is discussed and the comparison between damper position and steam pressure brought out in a way that will cause surprise to many engineers. In the bulletin complete specifications are given, together with

Steam used in thousands of pounds

	Fay Hotel			Mathews Hotel		
	1921	1922	1923	1921	1922	1923
Sept. . . .	107.2	92.9	42.6	41.0	30.8	33.4
Oct.	198.3	200.7	219.4	91.4	77.8	81.1
Nov. . . .	502.9	329.8	270.1	166.8	113.9	139.7
Dec.	593.3	464.6	367.0	172.0	178.1	158.7
Jan.	622.8	519.3	. . . . .	176.7	178.1	224.2
Totals for Sept., Oct., Nov., Dec.	1401.7	1089.0	899.1	431.2	400.6	412.9
	100%	77.8%	64%	100%	93%	95.5%

	Holland Hotel			Ormand Hotel		
	1921	1922	1923	1921	1922	1923
Sept. . . .	31.9	25.8	49.6	104.0	109.5	101.4
Oct.	107.4	110.6	120.6	186.8	292.7	239.7
Nov. . . .	225.4	150.3	189.3	310.9	260.9	289.6
Dec.	258.3	336.0	262.3	360.9	385.9	337.5
Jan.	297.1	334.0	338.0	465.4	451.1	564.6
Totals for Sept., Oct., Nov., Dec.	593.0	622.7	622.0	962.6	1039.0	968.2
	100%	105%	105%	100%	108%	100.5%

diagrams and lists of equipment required for 33 distinct methods of automatically controlling boiler-room equipment. Thirteen different methods of controlling powdered coal are included. Each method is illustrated and described and the necessary apparatus listed. Size 8½ x 11 in. Pp. 32 and 16, respectively.

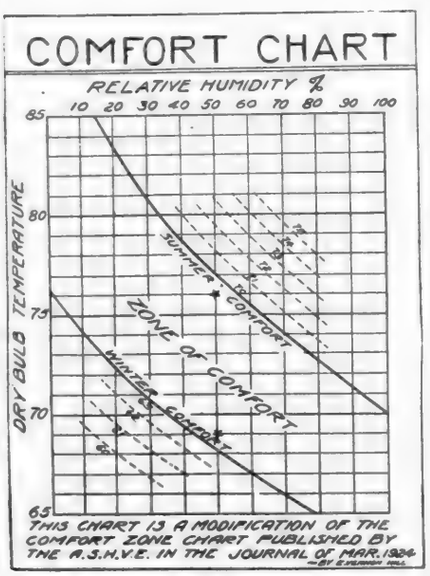
SOME NOTES ON THEATRE REFRIGERATION, written especially for architects, engineers and theatre owners, is the subject of a bulletin (No. 7) just published by the E. Vernon Hill Co., 64 West Randolph St., Chicago, Ill. The discussion of refrigeration methods is prefaced by a new "Comfort Chart," modified from that published by the American Society of Heating and Ventilating Engineers, in the *Journal* for March, 1924, based upon the investigations of the A. S. H. & V. Research Laboratory. As modified, the chart shows separately the conditions for summer and winter comfort. As will be seen, the zone of comfort is rather a wide area or band. The intersection of any vertical (relative humidity) line with any horizontal (temperature) line that falls within this zone represents a combination of temperature and humidity that will be comfortable to persons at rest, although in winter the best combinations approach the lower border of the zone and, in summer, the upper border.

This, says the author, is due to the fact that the clothing worn is much lighter during the summer months and the amount and also the heating value of the food eaten is less, and higher temperatures are, therefore, desirable.

A temperature of 69° F., with a relative humidity of 50%, shown by the star on the chart, is considered a comfortable winter condition, but for summer, with the same humidity, the temperature should be 76° F. as shown by star on "Summer Comfort" line.

Any point on the "Summer Comfort" line or close to it, states the bulletin, will be satisfactory in a refrigerated theatre, but to base conditions on the temperature only, without reference to the humidity, will invariably result in unsatisfactory conditions.

The reader is warned not to confuse the "effective" or "equivalent temperature" lines, as shown on the chart, as indicating ordinary temperatures, pointing out that the "equivalent temperature" lines take into account both temperature and humidity and are equivalent to a given air temperature when the air is completely saturated with moisture.



Dr. Hill's New Comfort Chart

REFRIGERATION METHODS

CALCULATIONS MADE FOR A MODERATE SIZE THEATER REQUIRING A MINIMUM OF 200 TONS OF REFRIGERATION

OUTDOOR CONDITION – DRY BULB 95° WET BULB 75°

ENGINEERING DESIGN	AIR CONDITIONS IN THEATER				
	DRY BULB TEMP.	WET BULB TEMP.	DEW POINT TEMP.	REL. HUM %	EFFECT. TEMP.
1— ALL AIR PASSED THRU COOLER	81.2	72.5	69	64	75.7
2— AIR COOLED AND REDUCED 50%	86.1	69.5	61	43	76.0
3— COOLING 50% ONLY	90.2	72.5	64	41	78.7
4— COOLING 50% RECIR. 50%	82.2	67.5	59	44	73.3
5— COOLING 100% RECIR. 50%	76.7	68.2	64	65	72.0
6— COOLING 50% REDUCING SUPPLY 25%	76.7	66.0	60	56	70.7

The bulletin then proceeds to take up six problems connected with the cooling of a moderate-sized theatre with a refrigerating apparatus having a capacity of 200 tons. The weather conditions assumed are 95° F. dry-bulb and 75° F. wet-bulb, or a relative humidity of 38%.

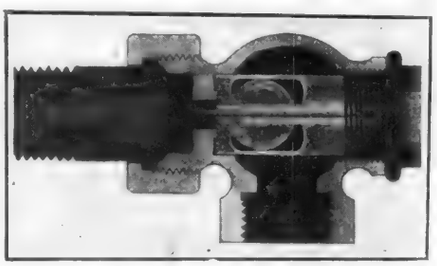
Problem 1 assumes that all the air is passed through the refrigerating apparatus before being delivered to the theatre. This gives a temperature in the theatre of 81.2° F., with a relative humidity of 64% and an "effective temperature," which is the true measure of comfort, of 75.7°, or 5.7° above that which is desirable. This naturally is an unsatisfactory installation and the operator endeavors to improve conditions by reducing the speed of the fan, thus cutting down the air supply. The results of this procedure are shown in Problem No. 2, where the air supply is reduced 50%. The temperature of the theatre goes up to 86.1°, the relative humidity is reduced to 43% and the effective temperature becomes 76°, slightly less desirable than before.

In Problem No. 3, one-half of the air is passed through the cooler. Conditions here are still worse. The temperature in the theatre will be 90.2° and the effective temperature 78.7°. In Problem 4, one-half of the air is recirculated through the cooler. This improves conditions, reducing the temperature to 82.2°, and the "effective temperature" to 73.3°, which is getting close to desirable conditions.

In Problem No. 5, the air is 100% cooled and 50% recirculated. This brings the "effective temperature" down to 72°. In Problem No. 6, the air supply is reduced to 25%, and 50% recirculated through the cooler. This brings the effective temperature down to within .7° of the ideal, even though the theatre is filled to capacity and the outside temperature conditions place a heavy load on the refrigerating apparatus.

The bulletin concludes with some useful cost data on refrigeration.

ISC SPECIALTIES, including radiator valves, radiator traps, drip traps, return-line traps, quick-vent valves and positive-return traps, are presented in circular matter received from the Ideal Specialty Co., Helena, Mont. One of the company's most interesting products is the ISC return-line valve, shown in the accompanying illustration. This valves comes in ½-in. size only. Its position is at the bottom of the radiator. As will be seen, this valve is fitted with a sleeve in which a hollow brass ball is placed. The ball is so placed that the water of condensation flows over the ball and valve seat so as to flush the ball and seat.



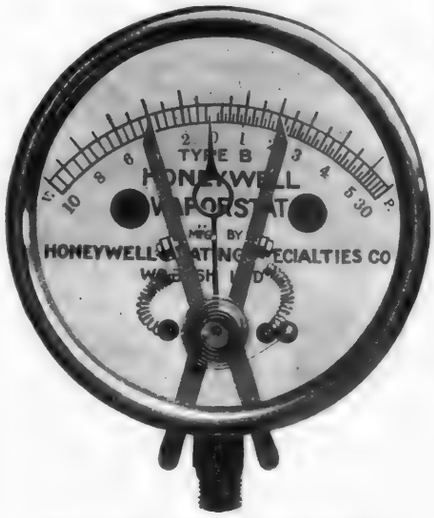
ICS Return-Line Valve

In this way both are kept washed. When the supply valve is closed, the ball is designed to seat itself, thereby closing the radiator from back pressure and at the same time producing a vacuum in the radiator so that when the supply valve is again opened, the radiator will fill with vapor.

PRESSURE FILTERS for clarifying water for steam boilers, swimming pools, textile mills, scouring and dyeing establishments, laundries, paper mills, hotels, public institutions, residences, etc., are described in a handsomely printed and illustrated catalog issued by the Cochrane Corporation, Philadelphia. The filtering medium employed is graded quartz sand and gravel, superimposed in layers and increasing in size towards the bottom, from which the water escapes through special strainer heads. The latter are so constructed that when the filter is back-washed the covers of the strainer heads lift, releasing particles which may have lodged in the strainer orifices. Provision is also made for agitation of the filter bed by means of compressed air during the back-washing process and for the automatic feed-

ing of alum or other coagulants during the filtering period, where required. An interesting application of such filtors is in connection with public swimming pools, where water is constantly withdrawn from the pool by a pump and forced through the filter and back into the pool. The water can also be slightly heated and chlorinated at the same time; its purity can thus be made to meet the most stringent specifications for drinking water. By means of an apparatus similar to a vacuum cleaner tool, sediment and slime are periodically removed by suction from the walls and bottom of the pool, saving the expense of emptying, scrubbing and refilling. Size 8½ x 11 in. Pp. 36.

TYPE B HONEYWELL VAPORSTAT, in improved form, is described in a new folder issued by the Honeywell Heating Specialties Company, Wabash, Ind. The company announces it has made



Honeywell Type B Vaporstat

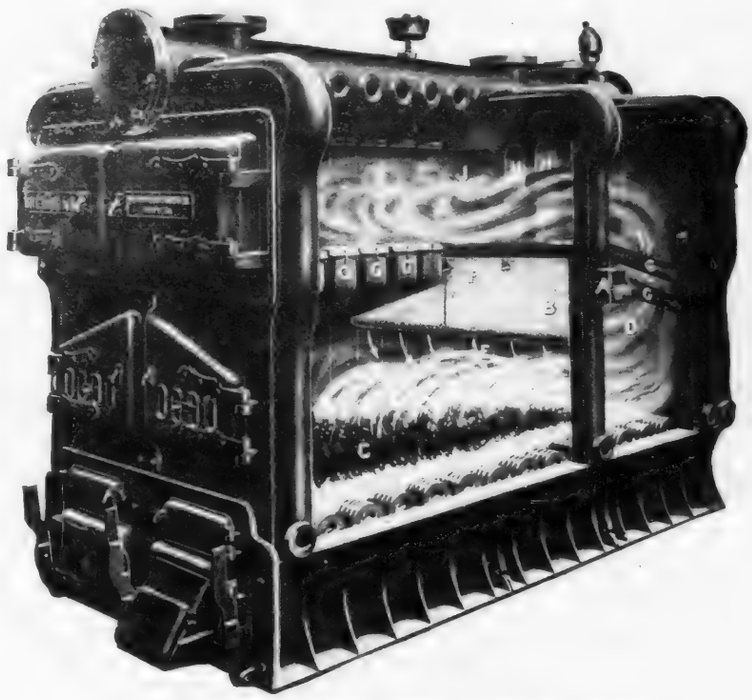
important improvements, designed to meet the peculiar requirements of domestic oil burners, so that the instrument now offers a flexible and accurate pressure control for Honeywell-controlled domestic oil burners. It is primarily designed for use as a limiting device or dual control with a Honeywell thermostat.

THRUSH REGULATOR, is the title of a new bulletin, issued regularly by H. A. Thrush & Co., Peru, Ind., in the interest of the Thrush system of water temperature damper control. The system consists of the Thrush water-temperature damper regulator and the Thrush pressure-relief and Thrush pressure tank, for controlling the pressure of the water in the system, thereby increasing the radiation capacity and preventing "easy boiling," as well as providing a safe overflow. The first number explains at length, in question and answer form, the salient features of the Thrush system and its operation. We understand the bulletin will be sent regularly, upon request, to those desiring it.

AUTOVENT ACID-PROOF AND MOISTURE-PROOF PROPELLER FANS, designed particularly for use in places where the surrounding hazards require the service of a fully-enclosed motor which will not be affected, are the subject of a new bulletin (No. 63) issued by the Autovent Fan & Blower Co., 730–738 West Monroe St., Chicago, Ill. As the manufacturers state, practically every type of standard ventilating fan requires some method of cooling the motor and, consequently, fans of this type, when installed for the purpose of exhausting acid fumes, steam and other corrosive substances, need protection for the motor. Air-tight inspection covers are used and, in addition, the motor windings are impregnated as an added protection against foreign substances. The bearings are of cast bronze alloy, while the wheels themselves are given two heavy coats of acid-moisture proof paint. Where desired wheels are furnished of copper or acid-resisting metal. Their design is similar to the standard Autovent types. Another new product being marketed by this company is a line of Autovent unit heaters.

RICHMOND HEAVY-DUTY SMOKELESS BOILERS AND RICHMOND SECTIONAL BOILERS are presented in two new and attractive catalogues issued by the Richmond Radiator Co., New York. The heavy-duty boiler described is a well-known product of this company, in use for many years, with the additional equipment of the Richmond smoke-preventing device for smokeless combustion of all grades of coal, coke, lignite, natural gas and fuel-oils. Richmond 25-in.–36-in. sectional boilers, of the push nipple pattern, are designed for steam, vapor, vacuum and water heating and will burn any kind of fuel, viz., hard or soft coal, coke, gas and fuel-oil. They are urged as a highly efficient boiler for residences, cottages, apartments, hotels, churches, schools, greenhouses, theatres, stores and private and public buildings, large and small. Richmond soft-coal boilers are so constructed that the Richmond device making them suitable for soft coal may be added without difficulty. The boilers also are constructed so that they may be installed in a spare room where no basement is available.

NATIONAL PIPE FOR POWER PLANTS is the subject of Bulletin No. 10, issued by the National Tube Co., Pittsburgh, Pa. The new bulletin is a handsome catalogue of 52 pages of excellent typography and illustrated with scores of photographs and drawings. Every phase and use of piping in industrial life is covered in the catalogue, which contains also many tables of specifications, weights, dimensions, test pressures etc., of various types of piping. Among the sub-headings used in the booklet are: uniformity, physical properties, ductility, welding and threading qualities, durability, inspection and tests and a description of the company's complete line of piping. Other chapters concern the special uses of "National" pipe, welding in power-plant piping and kindred subjects.

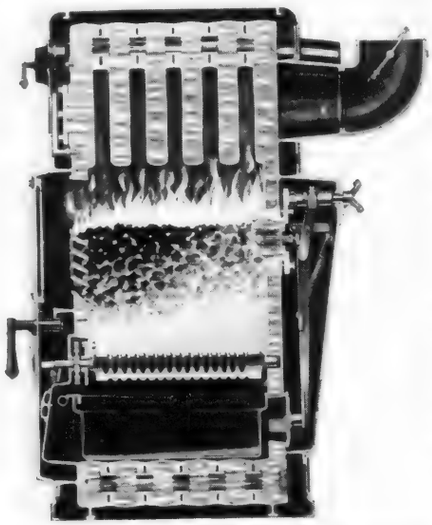


Richmond Heavy-Duty Smokeless Boiler

UNION UNIVERSAL BOILER of a new type, developed by the Union Iron Works, Erie, Pa., is described in detail in a new booklet published by the com-

pany. The new boiler is of the self-contained return-flue type and is made in sizes from 25 to 150 H. P. It is particularly adapted to installations where only small floor space is available. The booklet shows interior and exterior views, as well as sections through the boiler. Tables of data on dimensions, etc., are also included.

ARCOLA PARLOR, a new companion to the Ideal-Arcola, is a water heating boiler particularly adapted to cellarless homes. It is manufactured by the American Radiator Co., New York, and is described in detail in a colored folder recently issued. An exterior view of



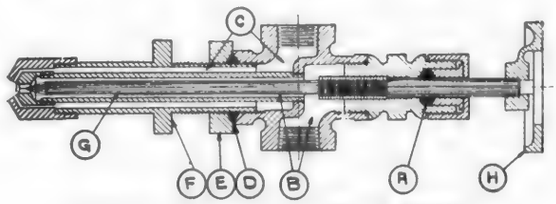
Construction of Arcola Parlor Heater

the new heater shows it to be beautiful in appearance in harmony with any scheme of interior decoration. The cover is made of sheet steel, finished with vitreous enamel, giving it a glass-like lustrous surface. Glow panels in a lock-safe fire-door are made of Pyrex glass. An interior view discloses the following features: automatic heat control regulator; draft panel, doing away with shifting weights; water-surrounded ash pit; looking-up smokehood. The manufacturers state that the water-surrounded ash pit construction seals the combustion chamber, allowing air to enter only through the draft inlet, which is under accurate regulation. This, it is claimed, makes for economical coal consumption. The Arcola Parlor is offered completely equipped with jacket, automatic draft regulator, altitude guage, thermometer, ashpan and firing tools. Additional sections can be added.

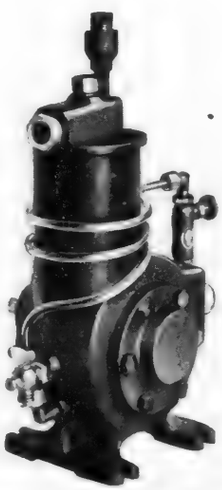
UTICA-IMPERIAL SUPER-SMOKELESS BOILERS FOR OIL BURNING, states a circular just issued by the Utica Heater Co., Utica, N. Y., have achieved the same success in burning oil that they have attained in burning soft coal. One reason given for this is that the increase in furnace volume in the direction of the flame insures the free expansion and thorough mixture of the oil with the air and consequent combustion of the gases before they come in contact with the heating surfaces. At the same time the baffle section, which has a jointless fire-brick covering, operates to retard the rapidity of the gas travel, in that way enabling the boiler to absorb the intense heat generated. Other features mentioned are the large combustion chamber, providing ample space for the mixture of the atomized oil and air, together with the length of travel necessary for complete combustion of the gases at a high temperature, and the substantial construction of this boiler, with its heavy tapered nipples, to take care of the expansion and contraction due to the wide variations in temperature which occur with oil burning. An interesting view shown in the folder is that of four 30-section Super-Smokeless boilers for heating Alden Park Manor, in Detroit, consisting of four eight-story buildings, with 88 five-room apartments in each building, or a total of 1760 rooms. The total heating load is equivalent to 83,900 sq. ft. of direct radiation. The boilers are equipped with Simplex oil burners and are each of 21,500 sq. ft. rated capacity. It has not been found necessary, however, to use the fourth boiler.

Boiler Room, Alden Park Manor, Detroit

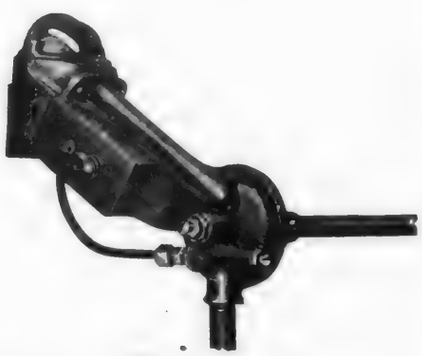
COMBUSTION FUEL-OIL BURNER, as now manufactured by the Combustion Fuel Oil Burner Co., Milwaukee, Wis., is presented in a new catalogue based upon the latest practice in this field. As the catalogue points out, the Combustion system utilizes the atomization method, employing an air jet. In an effort to simplify the machinery of oil burning, the air pressure, generated for atomizing purposes, is also used to draw the oil from the storage tanks and deliver it to the nozzle, thus eliminating the oil pump. The system is also designed to deliver air and oil in always definite proportions at uniform equal pressures as needed. The system is described as the only one using the cheapest grade of fuel-oil for home heating which has been fully approved by the Underwriters' Laboratories and listed as "standard." The five elements comprising the Combustion system, the air jet atomizer or nozzle, the pilot



Section Through Standard Nozzle



Motor-Driven Air Pump



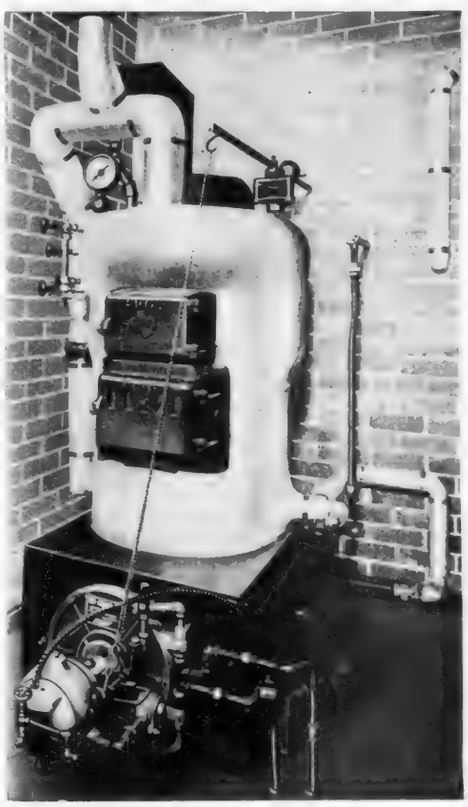
Pilot Ignition

Combustion Fuel-Oil Burner and Attachments

light, the motor-driven air pump, the automatic thermostatic controls and the oil-storage tanks, are each illustrated and described. The nozzle, it is pointed out, operates precisely like the ordinary nose or throat spray, having a central tube through which the oil flows, surrounded by a larger tube through which the air is forced. The air jet impinges on the central oil stream from all sides at a sharp angle, producing a mist effect which, it is stated, will result in a steady flame without the necessity of fire-pots or refractory surfaces to complete combustion.

The adaptability of the Combustion system to any type of heating plant is explained by the statement that one nozzle or a dozen may be operated from a single air pump unit. Nozzles are furnished in three sizes. Size 8½ x 11 in. Pp. 8.

RAY ROTARY FUEL-OIL BURNERS, for both high-pressure and low-pressure installations, are discussed in two new catalogues (Catalogue H, covering high-pressure work, and Catalogue C, covering low-pressure work) which have been received from the W. S. Ray Mfg. Co. Inc., San Francisco, Cal. Some indication of the success with which this burner has long been used on the Pacific Coast is given in the list of notable installations, not only in California, but in Minneapolis, Kansas City, Cleveland and other sections. Many typical installations are included, as well as a carefully-executed cut-away view of the burner itself with its various parts clearly indicated. Information is included covering sizes and capacities of burners, and directions are given for the installation of both alternating-current and direct-current burners. Size 8¼ x 11 in. Pp. (Catalogue H) 16, (Catalogue C) 12.

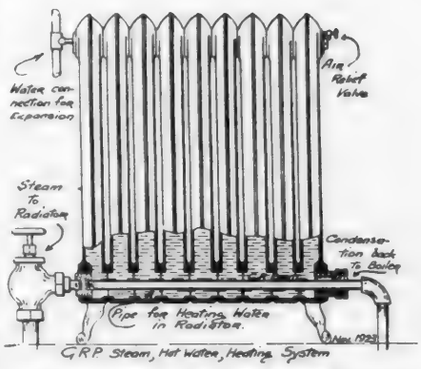


Ray Low-Pressure Fuel-Oil Burner Installed in Arco Boiler

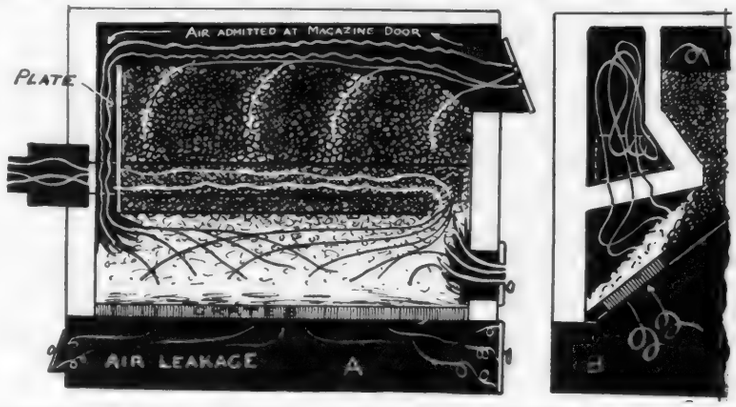
New Publications

COAL TRUTHS ON DAMPER REGULATION AND FURNACE EQUIPMENT, with "Stored Alberta Sunshine," has been published by the government of the Province of Alberta, Canada, under the authorship of George R. Pratt, fuel engineer. The manual deals particularly with the use of the Alberta free-burning coals in warm-air furnaces, in return-tubular boilers and in magazine-feed boilers. The text and illustrations are prepared for the benefit of the layman and show very clearly how and how not to fire this fuel. Numerous modifications of heater and grate design are presented, based upon the author's own experience. In the magazine-feed boiler, for instance, of the Spencer type, the author showed how he inserted a plate at the back of the magazine to prevent the fuel from being piled up to the back. The top of the plate is kept down from the roof of the magazine to permit of a flow of air over the fuel in the magazine down into the combustion chamber. This, he states, not only provides air for better combustion of the gases, but also prevents the formation of gas in the magazine, which was one of the problems encountered in burning this coal.

A novel arrangement of a heating system is also shown in the manual, consisting of a combination of a hot water and steam system. Water radiators were connected together with a ½-in. pipe to take care of the expansion. Each radiator was heated independently of the others by a ¾-in. brass pipe. The steam passing through the pipe served to heat the water in the radiator, 1 sq. ft. of brass pipe being equal to about 175 sq. ft. of water radiating surface. The total radiation installed was 470 sq. ft. in an eight-room house, frame construction, to take care of an outside temperature of—40° F. The total brass pipe in contact with the water was 21 lin. ft., or 5.775 sq. ft. The boiler, rating it at 7.5 sq. ft. per horse-power, is calculated to evaporate 172 lbs. of water per hour, while the brass pipe will condense 254 lbs. of steam per hour. The total of all radiators is equal to steam condensation of 118 lbs. per hour on a hot water basis. Thus the boiler has a capacity 50% greater than the radiation, while the brass pipe has 50% greater capacity than the boiler.

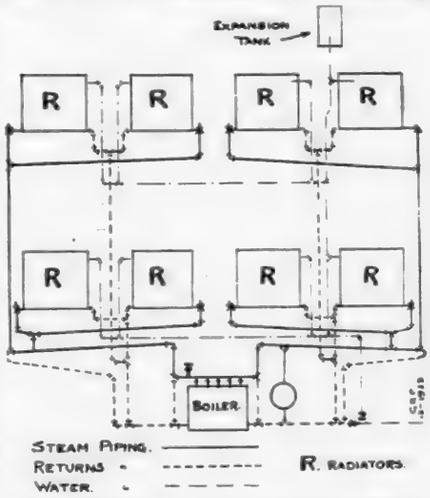

Water connection for Expansion
Air Relief Valve
Steam To Radiator
Condensation back To Boiler
Pipe for Heating Water in Radiator.
C.R.P. Steam, Hot Water, Heating System

Arrangement of Radiator Heated Independently by a Brass Pipe



Arrangement of Plate at Back of Magazine-Feed Boiler to Prevent Fuel From Piling Up to Back

One advantage of this system pointed out by the author is that one room can be quickly heated without heating the rest of the house. Also the amount of heat can be regulated by regulating the temperature of the water in the radiator. The manual is listed as No. 20 and is published at Coal Truth Office, 277 Smith St., Winnipeg, Can. Price 20 cents. Size 6 x 8 in. Pp. 32.



Arrangement of Combination Steam and Hot Water System

ELECTRIC HEATING OF RESIDENCES, PART II, by Edgar Allen Loew, professor of electrical engineering at the University of Washington, is the title of Bulletin No. 20, issued by the Engineering Experiment Station of the university. An abstract of the first bulletin was published in THE HEATING AND VENTILATING MAGAZINE for April, 1922. One of the interesting results of the investigation is that the electrical method of heating makes it possible to determine precisely the amount of heat energy required under various conditions of use. The accompanying table, for instance, shows the energy consumption for heating residences of from 8100 to 9900 cu. ft. volume. The low yearly totals are due, of course, to the climatic conditions in the Puget Sound region where from 5° to 10° below freezing represents the coldest winter weather and 87° F. a very hot summer day. The winters are relatively free from snow, as a rule. Among the conclusions reached in the investigation are the following:

1. Coal and wood continue to compete with electrical energy for heating where the approximate prices are about as follows:

Coal having from 10,000 to 13,000 B. T. U. per pound, selling at from $12.00 to $14.00 per ton delivered.

Wood, first growth fir, sawed in 12-in. lengths selling at about $10.50 per cord delivered.

Electrical energy at 5 cents per kilowatt-hour.

2. Apartments use, on the average, about 75% as much energy as isolated residences of the same volume.

3. The heat energy requirements of a residence are proportional to the temperature difference between the inside of the house and the outside and to the relative humidity. For the region and type of construction in question, the kilowatt-hours consumed per 1000 cu. ft. of volume per degree temperature difference and per degree relative humidity is about 0.17 kw-Hr.

4. It is apparent that the cheapest electrical energy available is off-peak energy generated from water power, where no water storage is available. In order to use such energy for heating, some form of heat energy storage must be provided. A water tank or cistern in which water may be heated and stored during the night time and from which hot water may be circulated through radiators as required, seems to be the most logical device for this purpose.

Skid Bar in Place of Rollers in New Stoker

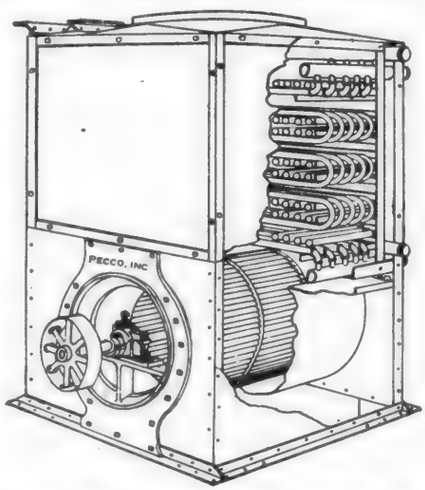
In the latest design of the Illinois stoker, manufactured by the Illinois Stoker Co., Chicago, Ill., skid bars are used, instead of rollers. In addition to the usual reduction in horsepower required to drive the chain, and the reduction of parts liable to break, the makers claim that their new skid bar cuts drippings a full 90%. A re-design of the Illinois Type G stokers damper-controlled tuyeres also features the new machines. Cast-iron with machined edges is now used, in place of the sheet steel found in the older installations. The change is designed to secure better air distribution and control, as well as to lengthen the life of these parts. An improved feed-grate operating device, with dust-proof housing, is now standard on the company's latest Type A stokers. Care has been taken in many of the improvements brought out by the company from to time to make them interchangeable with corresponding parts in older types, making it easy to modernize the earlier types of stokers.

The Pecco Unit Heater

Another addition to the types of unit heaters has been brought out by Pecco, Inc., 2951 North Market St., St. Louis, Mo., under the name of the Pecco steam heater. The unit consists of a blower and heating element. The heating element is comprised of a series of coils made up of ¾-in. wrought-steel pipe, bent and attached to headers. There is a set of coils in each heater which interlock to insure the passing of the air over all parts of the heating surface.

The blower has a double-width, double-inlet Sirocco wheel. A complete blower housing is arranged in the casing of the heater, with scroll and long-tapering inlets to secure maximum efficiency by properly guiding the air through the blower to the heating coils. Fully-enclosed SKF ball bearings, of self-aligning type, packed with grease, are used to reduce the friction to a minimum and to enable the heaters to operate a full heating season, under ordinary conditions, without renewing the grease.

The outlet from the heater is provided either with elbows or with a canopy top, where low outlet velocities



Pecco Unit Heater, with Sirocco Fan Wheel

are desired, and either type of outlet can be arranged to discharge the air in one, two, three or four directions. As an evidence of the good design of this heater, the manufacturers point out that the power required for the heater is about 1 H. P. for every 125,000 cu. ft. of space heated. The heaters can be furnished either in the floor type, inverted type or horizontal type. Special sizes and designs are also available to suit unusual conditions.

ENERGY CONSUMPTION FOR HEATING RESIDENCES OF FROM 8100 TO 9900 CU. FT. VOLUME

Month	Kw-Hrs. Total	Consumption Average	Per Cent Yearly Total	Actual Average Cost	Kw-Hrs per 1000 Cu. Ft.	Average Cost per 1000 Cu. Ft.	Average Outdoor Temp. F°	Average Temp. Difference $T_o-68°$	Kw-Hrs per 1000 Cu. Ft. per Degree Temp. Difference
January	159759	3994	15 9	$20 80	406	$2.10	40.3	27.7	14.7
February	143320	3557	14.1	18 40	361	1.87	42.8	25.2	14.3
March	140286	3510	13.9	18.15	357	1.85	44 6	23.4	15.2
April	112699	2820	11 2	14 60	287	1.50	47 2	20.8	13.8
May	90740	2270	9.0	11.80	231	1.20	53.6	14.4	16.0
June	34454	861	3 4	4 50	88	0.46	60.0	8.0	11 0
July	18224	455	1.8	2 35	46	0.25	61.4	6.6	7.0
August	12105	303	1 2	1 55	31	0.16	62 2	5.8	5.3
September	22496	562	2 2	2 90	57	0 30	56.3	11.7	4 9
October	52251	1305	5 2	6 80	133	0.70	52 3	15.7	8 5
November	86786	2170	8 6	11 30	221	1.15	45.6	22.4	9 9
December	135712	3390	13 5	17.50	345	1.78	38 4	29.6	11 7
Total	1008832	25197	100 0	$130 65	2563	$13 32			132.3
Average							50.4	17.6	11.0

Number of consumers considered 40
Average connected load ..... 12.2 kw.
Average estimated volume ..... 9840 cu. ft.

Average ratio: working space / idle space 2.7
Average annual load factor 23.6%

More Signs of Improvement

Farmers Buy More Freely—Optimism Returns

By L. W. Alwyn Schmidt

THE improvement in the general situation indicated by the straightening out of the forecasting curve of our chart during last month apparently has been of sufficient strength to prevent a further decline, with a strong promise of a very early movement in an upward direction. Speculation now is ripe, whether the improvement will be only short in duration or whether it will lead to a general recovery over all branches of the market.

A temporary acceleration of buying is noticed very often during this time of the year when the farmers are able to spend part of their earnings for purchases, delayed during the summer. But such a buying movement frequently dies down again after the most immediate demands have been satisified. Its duration, in fact, all is a matter of available cash. If the cash reserve in the hands of the purchaser is large, buying will extend over a considerable period. If it is limited, it restricts buying to the essentials and the buying movement ends immediately after the harvest season.

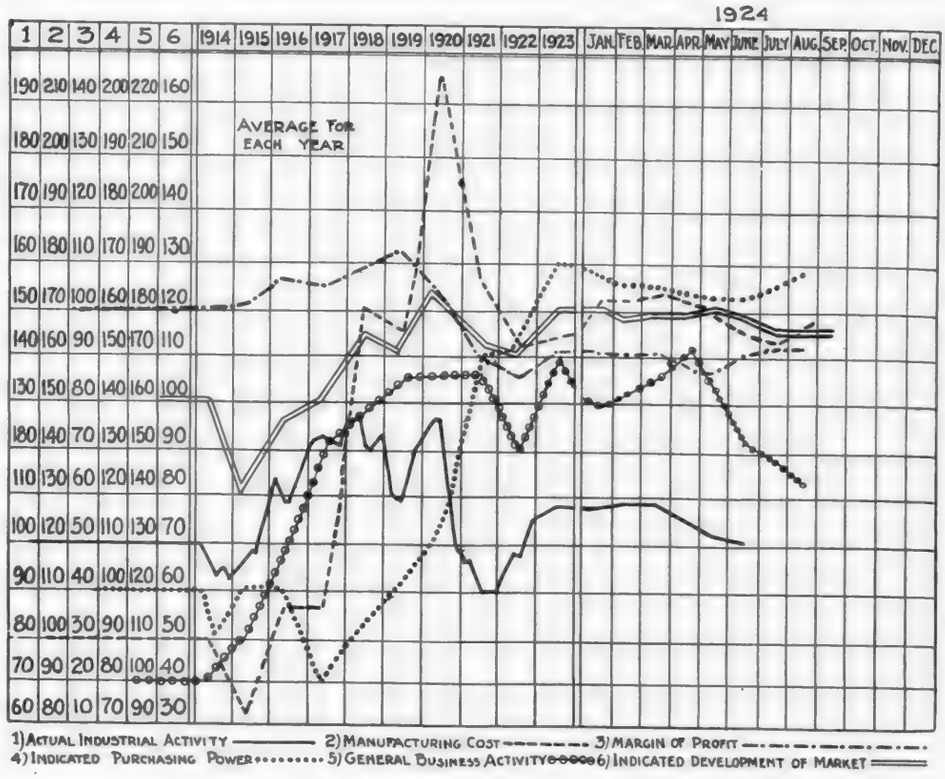
This year conditions seem to be favorable to the farmer. Prices of most leading farm products have increased and there has been, up to the present time, no marked increase in the cost of manufactured goods. In fact, the tendency in most so-called consumer's goods has been in the opposite direction. So the farmer will have more cash available than might have been expected earlier in the year. This will permit him to make improvements of farm property. It will provide means for necessary winter purchases and it will finally leave a small surplus for so-called luxuries or savings. The mail-order houses are feeling already the effect of this readjustment of the financial situation and it will not take long before its effects will be noticed also by the nation's industries.

But care should be taken, not to overestimate the strength of the present buying movement. True, the farmer is getting good prices and the purchasing power of his dollar is somewhat higher than before. But the farming communities have passed through bad times for at least one season. So part of the newly-earned money is bound to go in the payment of debts, a form of disbursement which, while helping the financial markets, is of no appreciable benefit to the manufacturer or retailer. It will take at least another season of plenty, with satisfactory prices, for the farmer to re-establish the farming sections as a strong factor in the national market.

This, then, lets us expect that the present buying movement, while healthy enough, will not be sufficiently strong to carry the market completely over its present depression. The improvement certainly is here but more substantial support is wanted for the market before it can return to the heights of prosperity which it enjoyed before the downward movement that started nine months ago.

On the other hand, there is little cause now to fear a backsliding. In fact, everything is in favor of a steady, if slow, improvement in the demand for merchandise from all sections of the country, which most certainly will continue right up to the Christmas season. The new purchase movement is likely to cover almost all branches of the national industries.

We have cautioned all along against an unguarded expansion of industrial equipment. What we have said early this year still holds good at the present time. Since the end of the war, manufacturing facilities have been widened considerably, while buying has continued upon practically the same level. We have to-day, therefore,



Analysis of Business Conditions at End of August

all the industrial equipment that we can make use of. This conviction is gaining more and more ground with manufacturers, with the result that comparatively little will be added to the nation's industrial tools, which, in turn, limits the production of such equipment to the normal replacement business. This, even at a favorable rate, can not exceed more than about 10% of its present value.

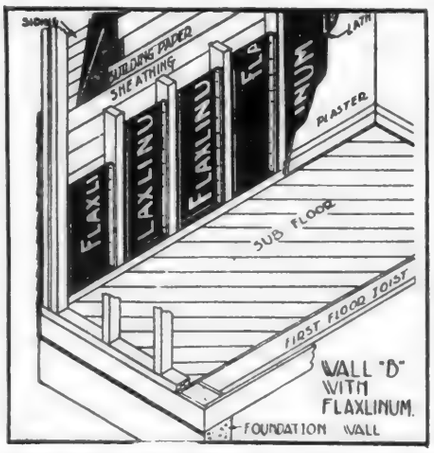
It explains why, in the face of the general recovery of the consumer's market, there is still noticeable a slackness in the so-called key industries, such as the steel industry, for instance. Improvement in those industries may still be delayed for some time until the market has gained sufficient strength to justify renewed expansion.

The present recovery of the market has appeared somewhat earlier during the year than might have been expected. This is rather a good sign because it will help the business activity in many industrial branches which, if it had come later, might have had to wait until next Spring for their own share in the new business that will now flow in the market. As it is, the clothing industries, including the shoe and leather industry, will take along a fair share of the new prosperity in their early winter business, with a considerable increase in orders during the next few months.

Higher prices for farm products, of course, cannot be obtained without an increase in the cost of living. It is doubtful, however, whether this increase will be large enough to impair seriously the purchasing power of the wage earner. So far the effect of higher living cost has been balanced by a decrease in the price of other commodities. The future development of the market depends very largely upon the price situation. If food prices, should by chance continue to increase during the winter, we may expect a slight decline in the consumer's purchase ability. The change, however, would have to be very considerable before it can re-act seriously upon the market. Taking, in this manner, all the uncertainties of the situation into consideration, there remains, nevertheless, enough to maintain that a definite change has come in the general atmosphere of the market. The spirit of depression which has governed it almost since the beginning of the present year has been replaced by one of hope. We are emerging from a severe attack of nerves, ready to take hold optimistically of any favorable opportunity that may offer itself.

Heat Transmission Through Building Materials with Flaxlinum Insulation

A striking example of the service a manufacturer can render the engineer and, at the same time, present the merits of his products, is seen in the figures compiled by the Thos. Moulding Brick Co., Chicago, Ill., showing the application of heat transmission coefficients, with and without insulation, to a small house. Most of the coefficients used by the company are those compiled by Willard and Lichty, and appear in detail in a bulletin published by the University of Illinois.

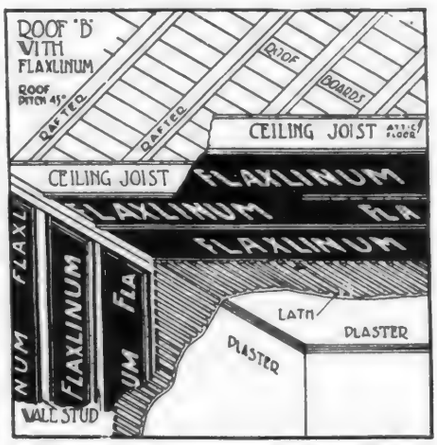


Flaxlinum Insulation Applied to Wall

Formulas are presented in the company's data, based upon these coefficients as modified by the application of Flaxlinum insulation and D and M boards. For instance, in connection with the heat transmission through the roof, the formula as given is that for use when the construction includes D and M boards, paper and shingles. Other figures show the modifications which may be made when Flaxlinum insulation is applied.

The actual heat losses are worked out in detail for a house using various types of wall construction, including stucco, frame and brick walls. Probably the most striking table is that showing the differences in the required radiation and the amount of coal consumed, as between the insulated house and the non-insulated house. For the same structure the difference in the required radiation is 25% and in the amount of coal used, 25%. The saving through the ceiling of the house, with the Flaxlinum insulation, is given as 44.4% and the saving through the average wall insulated with D and M boards, 39.8%.

It is further noted that the determinations as given on seasonal fuel consumption do not take into consideration the fact that a well-insulated house has a value of N (air infiltration changes per hour) less than for a non-insulated house. No absolute data on air infiltration in insulated houses, it is pointed out, are available. This is mentioned by the company as being, possibly, one of the factors accounting for the greater saving in fuel in practice than is shown by the computations.



Flaxlinum Insulation Applied to Ceiling

New Standard Radiation Estimating Table

Supplementary sheets for the Engineering Standards Book of the Heating and Piping Contractors' National Association have been issued, including a standard radiation estimating table. This table has been developed from data given in the pages of the Engineering Standards Book and is intended to simplify the problem of figuring the radiation required for any kind or type of room or building. Sheets similar to this, it is stated, have been developed for all of the cities whose exposure factors are given in the book and any of the sheets, including the one mentioned, can be obtained on cloth-backed paper at $1.00. The other new sheets comprise a revised page of factors for converting steam radiation into other types and a revised page of exposure factors and notes on same.

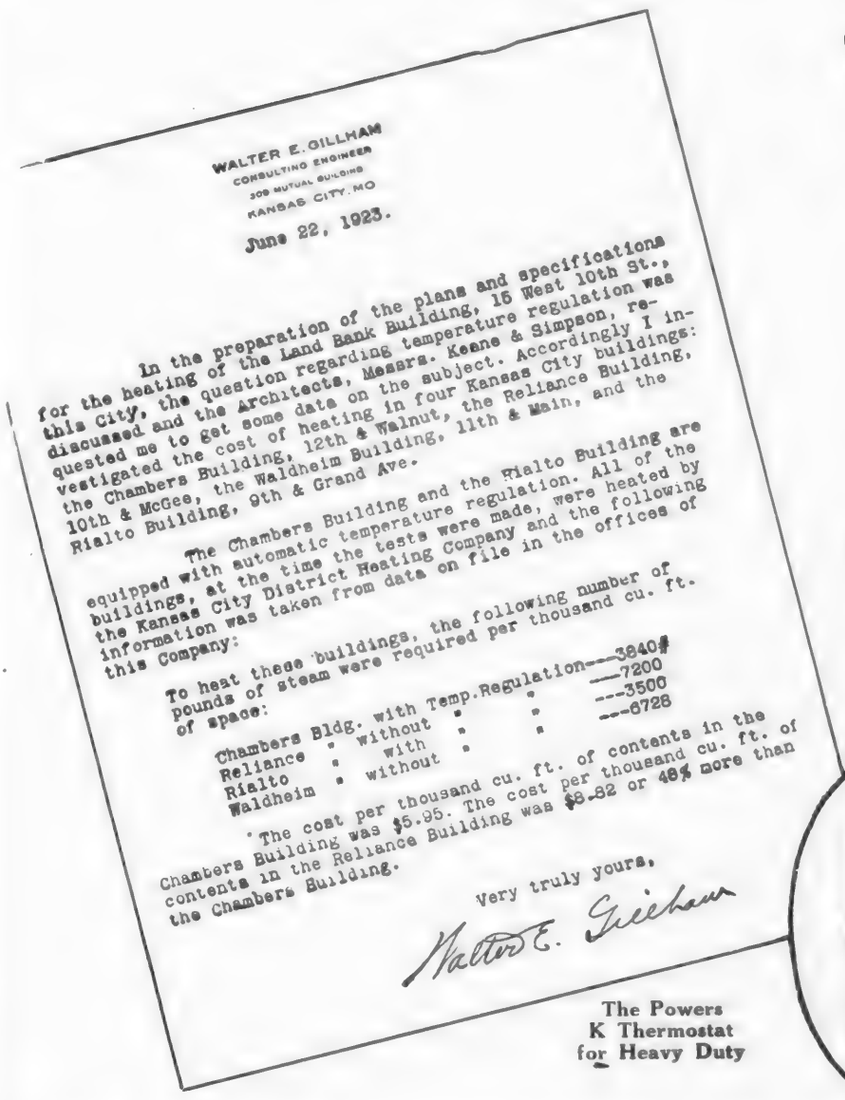
Deaths

A well-deserved tribute to "Charley" Glennon, executive secretary of the Master Steam and Hot Water Fitters' Association of Chicago, who died at his home in Chicago, May 24, was offered by the Secretaries' Conference of the Heating and Piping Contractors' National Association and adopted at the association's recent convention in Atlantic City. During the past two years Mr. Glennon had presided over the conferences of secretaries of local associations of the heating contractors' national association.

Mr. Glennon was 53 years of age. After an early apprenticeship in the shop of M. J. Carroll, of Oshkosh, Wis., he obtained further experience in the shop of W. S. Patterson, in Appleton, Wis. He went to Chicago in 1896, entering the employ of W. A. Pope as draftsman. In 1912 he formed the firm of Glennon-Bielke Company. Since 1917 Mr. Glennon has been an active member of the American Society of Heating and Ventilating Engineers.

Manufacturing Industries Drift Westward

The manufacturing industries of the nation continue to move westward to the Mississippi Valley, which produces most of the raw material required by them, according to statistics compiled by the National City Bank. The Atlantic coast, as a whole, still produces a little more than one-half of the manufactures of the entire country, but the share produced in the Mississippi Valley has grown from 19% in 1850 to 38% in 1900 and 41% in 1920.



WALTER E. GILLHAM
CONSULTING ENGINEER
308 MUTUAL BUILDING
KANSAS CITY, MO

June 22, 1923.

In the preparation of the plans and specifications for the heating of the Land Bank Building, 16 West 10th St., this City, the question regarding temperature regulation was discussed and the Architects, Messrs. Keane & Simpson, requested me to get some data on the subject. Accordingly I investigated the cost of heating in four Kansas City buildings: the Chambers Building, 12th & Walnut, the Reliance Building, 10th & McGee, the Waldheim Building, 11th & Main, and the Rialto Building, 9th & Grand Ave.

The Chambers Building and the Rialto Building are equipped with automatic temperature regulation. All of the buildings, at the time the tests were made, were heated by the Kansas City District Heating Company and the following information was taken from data on file in the offices of this Company:

To heat these buildings, the following number of pounds of steam were required per thousand cu. ft. of space:

Chambers Bldg. with Temp. Regulation---3840#
Reliance " without " " ---7200
Rialto " with " " ---3500
Waldheim " without " " ---6728

The cost per thousand cu. ft. of contents in the Chambers Building was $5.95. The cost per thousand cu. ft. of contents in the Reliance Building was $8.82 or 48% more than the Chambers Building.

Very truly yours,

Walter E. Gillham

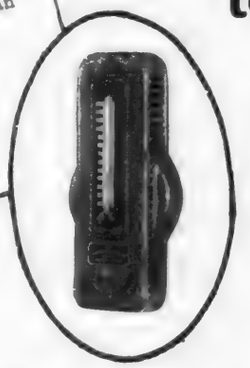
The Powers
K Thermostat
for Heavy Duty

This Test Shows

48 per cent

Saving of Steam

with POWERS temperature control



Partial List of Users

Sears Roebuck & Co.
U. S. Rubber Co.
B. F. Goodrich Co.
Eastman Kodak Co.
American Woolen Co.
E. I. DuPont de Nemours Co.
J. T. Ryerson Co.
Crane Co.
Carson Pirie Scott & Co.
Wm. Wrigley, Jr. Co.
DuPont Fabrikold Plant
Hartford Fire Ins. Co.
Willys-Overland Co.
Julius Kayser Co.
New England Tel. & Tel. Co.
Walter Baker & Co.
Phoenix Mutual Life Ins. Co.
Rothacker Film Co.
B. & O. Railway
Yellow Cab Mfg. Co.
Irving Pitt Mfg. Co.
Fleischmann Co.
Federal Reserve Bank, Kansas City, Mo.
Larkin Soap Co.
Consolidated Gas Co., New York City
Chicago Telephone Co.
Yale University
Princeton University

Does automatic temperature control in Workrooms, Offices, Schools, etc., really pay?

The proof shown in the above test is typical of many others which have shown remarkable savings of fuel with Powers automatic temperature control.

Tests show that the majority of workrooms are overheated. Eliminate overheating with Powers temperature control, and you improve the health and increase the output of workers. The effect overheating has on the output of men is shown in the report of the New York State Commission on Ventilation, which says:

"An increase of room temperature from 68° F. to 75° F. caused a decrease of 15 per cent in the physical work performed by men who were not compelled to maximum effort but were stimulated by a cash bonus."

Send for Interesting Book

Our book, "THE ELIMINATION OF HEAT WASTE," shows how and why a Powers System of Temperature Control gives such remarkably long and accurate service, and why its high first cost is cheapest in the end. May we send you a copy?

THE POWERS REGULATOR COMPANY

33 years of specialization in automatic temperature control

2718 Greenview Avenue, Chicago

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Des Moines
Detroit
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Indianapolis
Kansas City
Los Angeles
Milwaukee
Minneapolis
Nashville
New Orleans
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Pittsburgh
Rochester
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San Francisco
Seattle

CANADIAN OFFICES

Toronto
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Vancouver
Winnipeg
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2450-A

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

FUEL OIL HEATING

General Data

Pounds and Gallons Conversion Factor.—When speaking of oil consumption the pound is very often used as a basis of measurement. There are approximately 7.3 lbs. in a gallon of the lighter grades of fuel-oil (30° to 33° Baumé), gas-oils or distillates.

B.T.U. in Oil.—Kerosene, 20,000; gas-oil, 19,200; fuel distillate, 19,400.

Baumé is used in the petroleum industry to designate the gravity of oil. Gravity is expressed as degrees Baumé. There are two Baumé scales, one for liquids lighter than water and one for liquids heavier than water. When testing the Baumé of an oil the lighter scale must be used.

Hydrometer Tests.—Baumé tests are made with a hydrometer designed expressly for testing petroleum oils (lighter than water) and may be made by anyone without difficulty.

Flash-Point of an Oil.—The temperature at which it vaporizes and will "flash" when brought into contact with flame. The flash point of the fuel-oils (30° to 33° Baumé) is of underwriters' specifications which are 175° F. open-cup test. Kerosene flashes at about 125° F.

Oils, Crude, Distillate, Fuel.—Crude oil is the oil in its crude state as it comes from the earth. This is valuable and seldom used for fuel purposes. It is first "cracked" or distilled" and the gasoline taken off, then a further cracking or distilling takes off the kerosene. This is followed by other processes resulting in many products, among them distillate, and the residue—fuel-oil. The lighter grades of fuel-oil (30° to 33° Baumé) are preferable for home heating as they are but slightly affected by low temperatures, and require no preheating.

Boiler Rating in Relation to Fuel Consumption.—The square feet rating of a steam boiler divided by 50 will give the necessary number of pounds of oil to be burned in order to secure the maximum efficiency. To illustrate, a 2000-sq. ft. capacity boiler will require 40 lbs. of oil an hour at rating.

Firebox.—To burn without smoke, the firebox should have ½ cu. ft. of volume for each pound of oil burned per hour. All standard boilers have this capacity, but special attention should be given to the fireboxes of boilers to be converted from gas to oil.

Cost Comparisons.—One ton of coal at $13.25 compares with 100 gals. of oil at 8 cents per gallon ($8.00), under good conditions, or 135 gals. of oil at 8 cents per gallon ($10.80). In some cases where carelessness has been the rule with coal, 100 gals. of oil will be the heating equivalent of a ton of coal, while in other cases where boilers have been efficiently handled with coal, it will be necessary to burn 135 gals. of oil to secure the heating equivalent of a ton of coal.

Caloroil Burner Corporation.

FUEL-OIL General Data | No. 48

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

FUEL-OIL

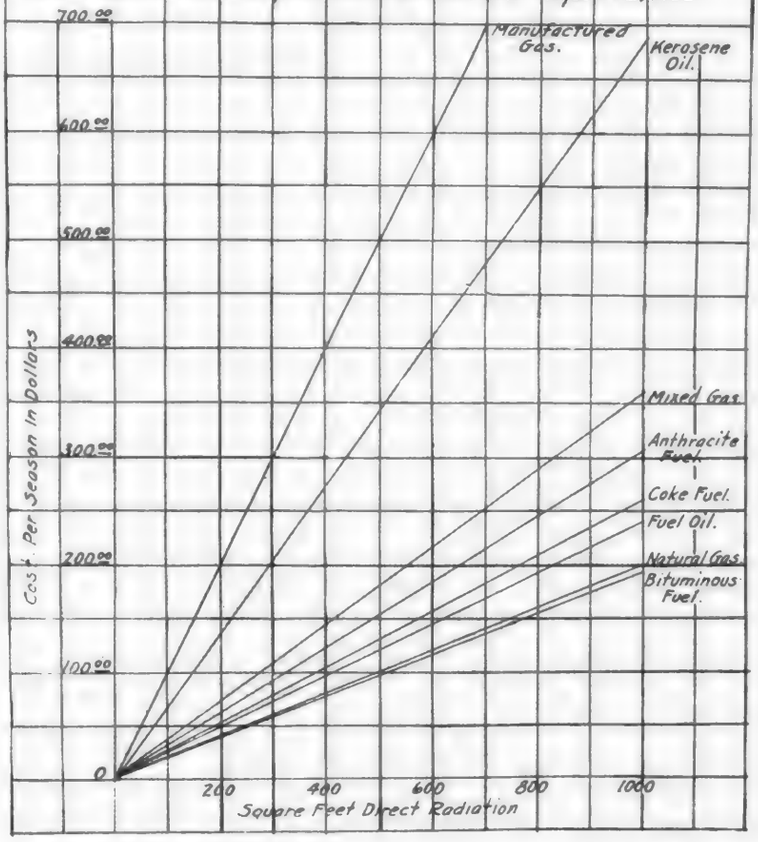
Comparative Cost of Fuel-Oil

CURVES SHOWING COST OF VARIOUS FUELS
AT DIFFERENT PRICES — PER SEASON OF 5000 HOURS.
AVERAGE LOAD EQUAL TO ONE-THIRD CONTINUOUS FULL LOAD.

Kind of Fuel	Price Dollars	Calorific Value B.t.u.	Efficiency of Boiler	B.t.u. 1.00 Will Buy	Cost to heat 50 Sq. Ft. Steam Radiator Per Season
Bituminous	6.50 Per Ton	13500 Per Lb	50%	2.080.000	9.62
Coke	10.50 " "	11500 " "	70%	1.530.000	13.05
Anthracite	12.50 " "	12500 " "	65%	1.300.000	15.40
Fuel Oil	.06 " Gal.	19500 " "	70%	1.660.000	12.05
Kerosene	18 " "	20000 " "	73%	583.000	34.35
Natural Gas	.40 Per 1000 Ft³	1000 " Cu. Ft.	80%	2.000.000	10.00
Mixed Gas	.65 " " "	900 " " "	80%	1.110.000	18.05
Manufactured Gas	1.20 " " "	600 " " "	80%	400.000	50.00

Automatic Or Hand Regulation on Oil or Gas Burning Installations Will Lessen Cost Of Operation

Curves Based on Prevailing Prices at Buffalo, N.Y. August 1st, 1922



FUEL-OIL—Comparative Cost of Fuel-Oil | No. 48-A

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

FUEL-OIL

Contents of Horizontal Cylindrical Tanks Partially Filled

Dia Feet	Depth of Oil Feet.	Gals per 1 Ft. Length	Dia Feet	Depth of Oil Feet	Gals per 1 Ft Length
3	½	5.81	4	4	94.00
	1	15.41	4½	½	7.21
	1½	26.44		1	19.66
	2	37.47		1½	34.67
	2½	47.07		2	51.02
	3	52.88		2½	67.95
3½	½	6.32		3	84.30
	1	16.99		3½	99.31
	1½	23.50		4	111.76
	2	42.47		4½	118.97
	2½	54.98	5	½	7.64
	3	65.72		1	20.91
	3½	71.97		1½	37.06
4	½	6.78		2	54.86
	1	18.38		2½	73.44
	1½	32.20		3	92.02
	2	47.00		3½	109.82
	2½	61.80		4	125.97
	3.	75.62		4½	139.24
	3½	87.22		5	146.88

Note—Measure depth of oil in tank with measuring rod. Refer to proper diameter of tank and depth of oil from rod. Multiply corresponding gallons per 1 ft. length by length of tank in feet. Result will be number of gallons of oil in tank

FUEL-OIL—Tank Contents | No.48-B

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

FUEL-OIL

Combustion Rates for Different Boiler Capacities

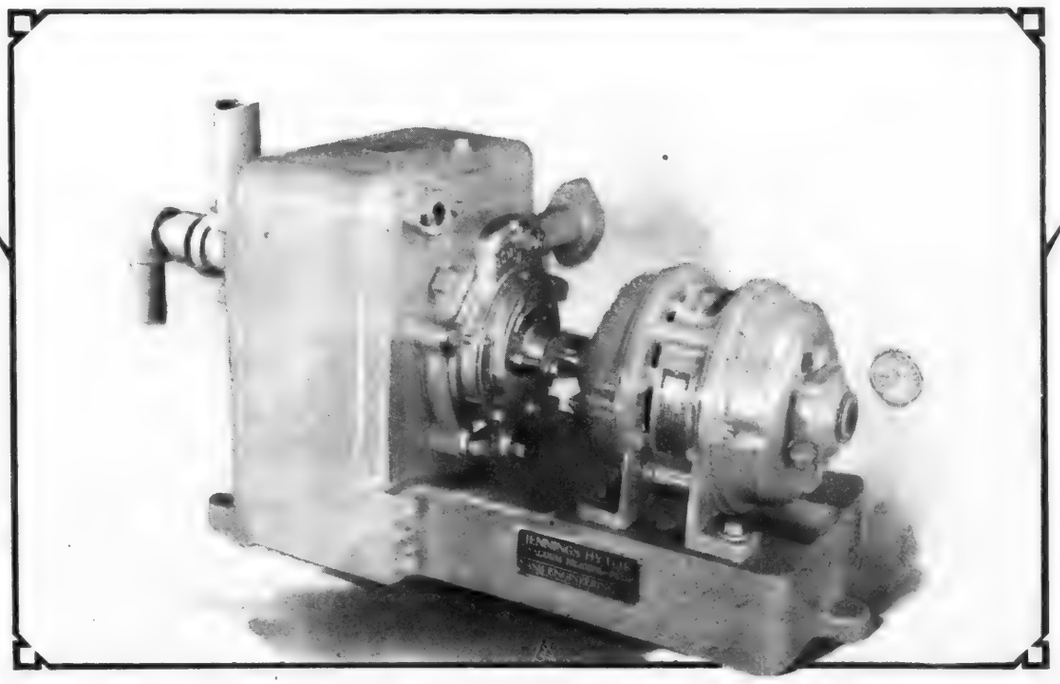
CAST IRON STEAM & HOT WATER BOILERS

Boiler Rating — 0 Lbs Steam	Boiler Rating — Equival. Hot Water	Lbs. Oil required per Hour to evaporate following Lbs of Water per Lb. of Oil — 12 Lbs	13 Lbs.	14 Lbs.	15 Lbs.	16 Lbs.
300	500	6.25	5.77	5.36	5.00	4.69
400	650	8.33	7.70	7.14	6.67	6.25
500	820	10.42	9.62	8.93	8.33	7.81
600	1000	12.50	11.54	10.71	10.00	9.38
700	1150	14.58	13.46	12.50	11.67	10.94
800	1325	16.66	15.38	14.29	13.33	12.50
900	1500	18.75	17.31	16.07	15.00	14.06
1000	1650	20.83	19.23	17.86	16.67	15.63
1200	2000	25.00	23.08	21.43	20.00	18.75
1400	2325	29.16	26.92	25.00	23.33	21.88
1600	2650	33.33	30.77	28.57	26.67	25.00
1800	2950	37.50	34.62	32.14	30.00	28.13
2000	3290	41.67	38.46	35.71	33.33	31.25
2200	3600	45.83	42.31	39.29	36.67	34.38
2400	3950	50.00	46.15	42.86	40.00	37.50
2600	4280	54.17	50.00	46.43	43.33	40.63
2800	4620	58.33	53.85	50.00	46.67	43.75
3000	4800	62.50	57.69	53.57	50.00	46.88
3500	5600	72.92	67.31	62.50	58.33	54.69
4000	6400	83.33	76.92	71.43	66.67	62.50
4500	7200	93.75	86.54	80.36	75.00	70.31
5000	8000	104.17	96.15	89.29	83.33	78.13
5500	8800	114.58	105.77	98.21	91.67	85.94
6000	9600	125.00	115.38	107.14	100.00	93.75
6500	10700	135.41	125.00	116.07	108.33	101.56
7000	11530	145.83	134.62	125.00	116.67	109.38
7500	12340	156.25	144.23	133.93	125.00	117.19
8000	13150	166.67	153.85	142.86	133.33	125.00
8500	13970	177.08	163.46	151.79	141.67	132.81
9000	14790	187.50	173.08	160.71	150.00	140.63
9500	15600	197.92	182.69	169.64	158.33	148.44

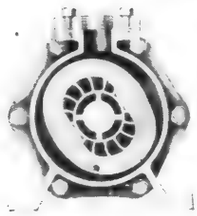
American Standard Oil Burner Company, Oakland, Cal.

FUEL-OIL—Combustion Rates for Different Boiler Capacities | No. 48-C

Copies of this Data Sheet, printed separately, 5 cents each.



Type "M" Pump,–ideal for small heating installations



Sectional view of Jennings Hytor showing principle of operation

The rotor, consisting of a cylindrical hub around the periphery of which are chambers or spaces formed by heavy shrouds cast integrally, revolves freely in an elliptical casing or housing filled with water. As the rotor turns, it carries the water around with it. The water, under the influence of centrifugal force, is compelled to follow the contour of the casing, and alternately to enter and leave the rotor chambers, twice in each revolution. As the water recedes from the rotor, air is drawn into the chambers through the inlet port. As the water is subsequently forced back into the rotor by the converging casing, the air is compressed and then discharged from the rotor through the outlet port.

The Jennings Hytor Vacuum Heating Pump, type M, embodies the superior advantages of all Jennings return line heating pumps—simple, sturdy and compact in design and construction, reliable and quiet in operation, discharge positive and free from pulsation. It is essentially made for small heating installations where heretofore the use of a high grade pump has been prohibitive because of the outlay involved.

The type M, as shown by the illustration, consists primarily of two pumping units—the air pump for removing the air and discharging it into the atmosphere without back pressure, and a separate unit, the water pump, for removing the condensation and forcing it into the boiler or hot well, a feature of design that accounts for a 50% saving in motor horsepower, since nearly 80% of the fluid ordinarily handled is air.

Both pumps are combined and suitably arranged in connection with the large settling chambers, so that the whole outfit is self-contained. No piping connections need to be made between the pump and receiver. For complete information, write for copy of Bulletin No. 25.

Jennings Hytor

NASH ENGINEERING CO SOUTH NORWALK CONN

2003-38

Trade and Miscellaneous Notes

Miscellaneous Notes

Coal Committee of the American Engineering Council reports that danger of coal famine will be eliminated, the industry stabilized, railroads relieved and the consumers' coal bills ultimately reduced by seasonal storage of coal. W. L. Abbott, M.W.S.E. was chairman of the committee, which was assisted in its work by 67 sub-committees in important industrial centers. The Department of Commerce, U. S. Coal Commission and Federal, State and Municipal agencies also co-operated. The report states that the amount of storage required to produce constructive results is small in terms of annual consumption.

National Industrial Conference Board has issued a mid-year bulletin on industrial and economic conditions in the United States. The report points out that although production and distribution during the first six months of the year have been below that of the similar period last year, it should be remembered that the first six months of 1923 witnessed the height of the trade boom. Production is above the average and the end of the slump is in sight, the report states.

Better Homes in America has published a booklet entitled "Plan Book of Small Houses" to aid prospective owners or builders of houses containing up to six rooms. The book may be obtained from Better Homes in America, 1653 Pennsylvania Ave., Washington, D. C. for 25 cents, the cost of issuing it. The organization is non-commercial and purely educational in character.

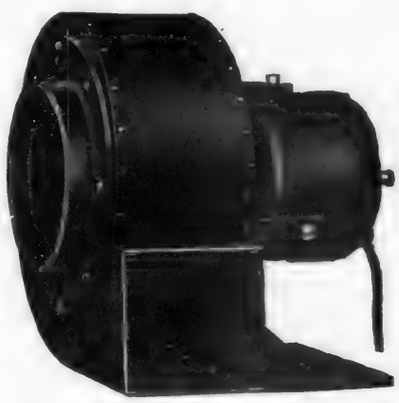
Building Activity continued fairly heavy during July when the drop was only 10% below the preceding month, according to the F. W. Dodge Corporation. Contracts awarded during the month totaled $347,184,300. Of chief interest in the July statistics is the fact that the character of building was more nearly normal than previously. Residential construction was 37% in July, public works and public utilities amounted to 21% and commercial buildings was about 14%, industrial buildings 6% and educational buildings, 11%. Contemplated new work reported in July was in moderate volume, amounting to $430,500,700.

William J. Woolley, manager of the National Trade Extension Bureau, who was operated on in Evansville, Ind., July 10, is reported to be improving rapidly.

Rensselaer Polytechnic Institute, Troy, N. Y. will celebrate its centennial October 3 and 4, 1924, when official delegates from educational institutions, scientific organizations and engineering societies throughout the world will visit it. Rensselaer is the oldest college of science and engineering in the English-speaking world. Herbert Hoover, Secretary of Commerce, Gov. Alfred E. Smith of New York, and the presidents of various scientific and engineering organizations will deliver addresses on the first day of the celebration. Educators of the country will do Rensselaer honor on the second day.

Tenth Exposition of Chemical Industries has issued an announcement correcting the opinion, prevailing in some quarters, that the exposition is to be

UNIBLADE VOLUME BLOWERS



Uniblade Volume Blowers are widely used for smoking room, toilet, laboratory, residence and numerous other installations, due to their efficiency, low power consumption and quiet operation.

The type shown has a universal discharge arrangement and is so designed that the drive is interchangeable from right to left hand. The motor suspension frame permits changing motor to either alternating or direct current, when necessary.

The fan wheel is over-hung on the motor shaft eliminating a bearing on the inlet side of the unit.

These units are manufactured in two types, on which full specifications are given in our new Eleventh Edition Catalog. Send for your copy.

Sales Offices in Principal Cities

Stocks of Autovent Propeller Fans are Carried in

New York, Boston, Detroit, Kansas City, Dallas, San Francisco, Los Angeles, Peoria

AUTOVENT FAN & BLOWER CO.

730-738 W. MONROE ST. - - CHICAGO

held this Fall. The date of the next exposition is September 28 to October 3, 1925, and the exhibition will be held, as usual, at the Grand Central Palace, New York.

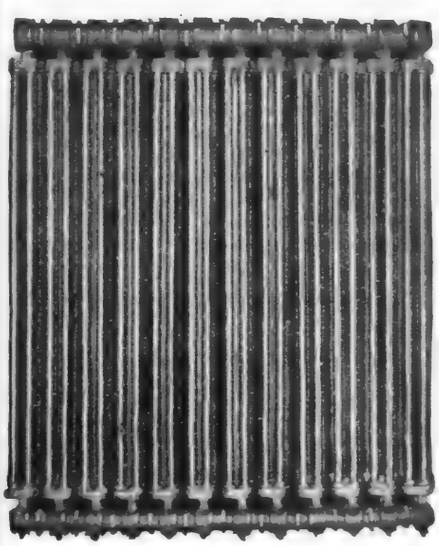
National Safety Council will hold its thirteenth annual safety congress in Louisville, Ky., September 29 to October 3, 1924. The story of the progress that has been made in safety activities during the past year will be shown in addresses, exhibits, motion pictures and lantern slides. More than 4,000 industrial plants and community safety councils will be represented at the gathering.

St. Louis, Mo.—Business conditions in the St. Louis district are reported to be much better this year than in the eastern district, according to A. C. Skinner, president of the Skinner Bros. Mfg. Co., which in addition to its local factory for the manufacture of the Baetz air heaters, operates a factory at Elizabeth, N. J. The company reports a substantial increase in business in the St. Louis district for the first six months of the present year.

Third National Exposition of Power and Mechanical Engineering, which will be held at the Grand Central Palace, New York, December 1-6, promises to be the largest ever held. Over 260 exhibitors have been assigned space at the show. This is more than twice the number at the same time a year ago. As usual the show will coincide with the meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers.

Thirteenth Annual Safety Congress, which will be held, under the auspices of the National Safety Council, at the Hotels Brown and Seelbach, Louisville, Ky., September 29—October 3, will hold numerous sectional meetings on safety in connection with construction, ice and refrigeration, and petroleum. One of the principal addresses at the opening session will be on "Co-Operation in Safety Among Trade and Other Associations," by Richard F. Grant, president of the Chamber of Commerce of the United States.

Hot Blast Heating Perfected by the Lyon Interlocking Heaters



Front View

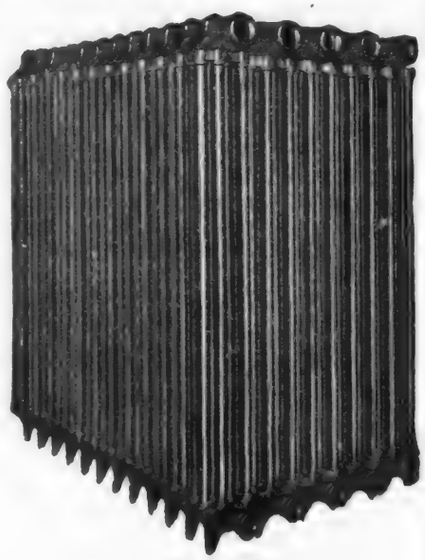
Their many superior features recommend them to the heating expert

The Lyon Interlocking Heaters are built in small sections of eight one inch pipes with Headers and Base, put together by Hydraulic pressure without threads. The Sections are assembled with exra heavy Right and Left Nipples. The Headers and Bases are made interlocking which allows for close assembling and the staggering of all pipes in the completed Heater.

Thousands of feet in daily use under pressure up to 100 lbs.

Some Territory Still Open to Reliable Agents

Send for descriptive circular and information regarding Heaters for all purposes



Back View

These Heaters are made in the following sizes:

Height	40″	50″	60″	70″	80″	90″	100″	110″	120″	130″	140″
Sq. Ft.	10.6	12.9	15.2	17.5	19.8	22.1	24.4	26.7	29.	31.3	33.6

LYON PRODUCTS COMPANY, Inc., *312-316 Union Park Court, CHICAGO, ILL.*

SEE OUR DETAILED DATA IN ASH&VE GUIDE

MANUFACTURED WEATHER makes "Every day a *good* day"

Humidification · Dehumidification
Heating · Ventilation · Purification
Drying

Carrier Engineering Corporation

750 Frelinghuysen Ave. Newark, N. J.

Boston Buffalo Chicago New York Philadelphia Los Angeles

SEE OUR DETAILED DATA IN ASH&VE GUIDE

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

Pioneers

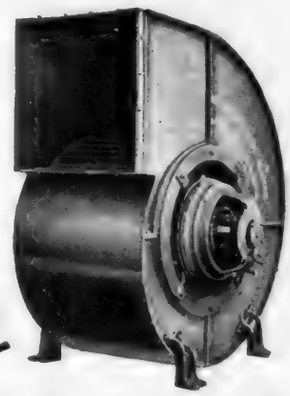
This is number 1 of a series of advertisements relating to ILG developments. Read the series carefully and find out how many of the "latest things" in fans, blowers and unit heaters have been pioneered by ILG.

EVER since 1909, when ILG ELECTRIC VENTILATING CO., first began to build blowers, they have advocated direct connected blowers with straight multi-blade wheels running at high tip speeds so as to favor direct connection to electric motor. This was done because the ILG COMPANY'S designers were electrical men and they knew that the electric motor was inherently a high speed machine. ILG contended from the first that the forward-pitched, low tip-speed wheel belonged to the steam engine age because the steam engine was inherently a low speed machine. ILG insisted also that the wheel should be light, not heavy and that the housing should be heavy, not light.

This was fifteen years ago and ever since that time up to the present, the ILG sales engineers all over the United States have been battling with architects and consulting engineers (with considerable success) to gain recognition for the ILG design.

Now, comes help from unexpected quarters. Several prominent fan designers have discovered recently, that the electric motor is inherently a high speed device and they are bringing out fans with high tip-speeds for direct connection to electric motors and are using lighter wheels mounted in heavier housings and are claiming the same virtues that the ILG ELECTRIC VENTILATING CO. has pointed out for the *last fifteen years.*

ILG Direct Connected Blower; 1909 Design. From the beginning ILG Blowers were built to favor the inherent high speed of electric motors.



ILG Direct Connected Blower; 1924 Design. Ball Bearings, grease lubrication. No bearing in the inlet. No coupling. Small expense of installation, simply bolt four feet down and blower and motor are installed. One name plate guarantees both motor and blower.

ILG ELECTRIC VENTILATING COMPANY

2858 NORTH CRAWFORD AVENUE :·: CHICAGO, ILLINOIS

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

Ventilation

FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS · RESTAURANTS · THEATRES · HOUSES · ETC ·

Manufacturers Notes

DeLaval Steam Turbine Co., Trenton, N. J. has announced that the Wm. Constable Co., Providence Building, Duluth, Minn., will represent it in that territory in the future, the Constable Company having purchased the H. J. Rich Co., its former agent. The territory covered by the Wm. Constable Co., includes parts of Minnesota and Wisconsin and northern Michigan. Mr. Constable was chief mechanical and electrical engineer for the Republic Iron & Steel Co., for the past five years and previously had been with the General Electric Company.

Scott Valve Mfg. Co., Detroit, Mich., has appointed H. L. Woolfenden director of sales promotion. Mr. Woolfenden is a graduate engineer and recently has been in charge of sales and engineering in the Rocky Mountain district, with headquarters in Denver, Colo., for the Allis-Chalmers Manufacturing Company.

Pecco, Inc., St. Louis, Mo., manufacturers of heating, ventilating and dust collecting equipment, has named F. J. McMorran as manager of sales engineering. Mr. McMorran has been connected with the American Blower Company.

Oil City Boiler Works, Oil City, Pa., has made a change in its Atlanta, Ga., office, designating the branch by the corporate name. John C. Candler has been named district manager, with headquarters at Marietta and Spring Streets, Atlanta.

American Radiator Co., New York, has removed its offices from 104 West 42nd Street to 40 West 40th Street, where the company has erected a 25-story building. Inspection of the new building by architects and engineers is invited by the company, which has issued an attractive announcement of the new location.

O-E Specialty Mfg. Co., Milwaukee, Wis., manufacturers of O-E "3-in-1" vapor-vacuum-pressure fittings and other specialties, announces the establishment of a branch in Seattle, Wash.,

PUBLIC SCHOOL No. 62, BRONX, New York City, N. Y.
Over one Hundred Lehigh Fans are installed in New York City Schools
Engineers—New York Board of Education.
Contractors—Federal Heating Co., New York City

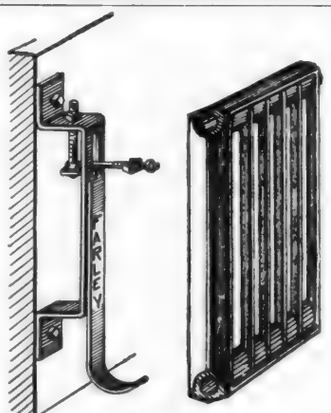
LEHIGH MULTIBLADE FANS

FOR HEATING AND VENTILATING

WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior to, any other fans on the market.

HERSH BROTHERS CO.

654 Mill Street ALLENTOWN, PA.



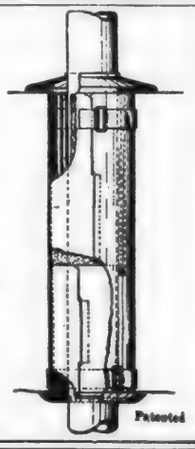
Patented

FARLEY

Hangers *and* Sleeves

This is the hanger you are looking for, made of hot rolled steel, will not break and made to fit any style of your radiation.

Fire resisting "Grab-on" sleeves are used in all classes of buildings. They are made to fit the condition of construction of the building. The only sleeve that will hold covering against the ceiling.



Send for descriptive literature

FARLEY SLEEVE AND HANGER COMPANY
3748 East 71st Street and Fleet Ave. Cleveland, Ohio

At work on part of a two mile installation o the Johns-Manville Underground System of Insulation at Cornell University, Ithaca, N. Y.

Built Right

because our men know their jobs

THE installation of underground pipe lines is a specialty—requiring special skill and experience.

For that reason, every installation of the Johns-Manville System is planned and supervised by experienced Johns-Manville specialists and preferably installed by trained Johns-Manville workmen.

These men know their jobs from start to finish. Their skill is largely responsible for the exceptional satisfaction that hundreds of Johns-Manville installations are giving to-day.

JOHNS-MANVILLE Inc., 292 Madison Ave. at 41st St., N. Y. C.
Branches in 62 Large Cities
For Canada: Canadian Johns-Manville Co., Ltd., Toronto

Through Asbestos and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE

Underground System of Insulation

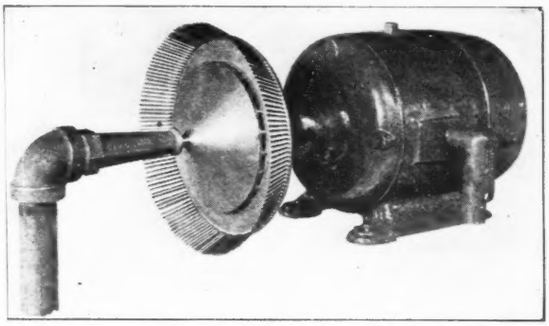
which will carry a complete stock of the company's specialties for distribution in the Seattle territory. Clyde E. Hayes and J. J. Finnigan, both of whom are heating and ventilating engineers formerly in the engineering department of the U. S. Government, have charge of the Seattle branch. Sales offices have been established in the Colman Building, Seattle.

Hoffman Specialty Co., New York, announces the appointment of Frank H. Gaylord as manager of its Chicago branch. From 1918 to 1923 Mr. Gaylord was manager of the company's Minneapolis branch and, for the past six months, he has represented the company in the Pittsburgh territory.

Schleicher, Inc., 218 South Wabash Ave., Chicago, Ill., has been organized by Edward Schleicher, for the past seven years president and general manager of the Art Metal Radiator Cover Company, to continue the production of Art Metal radiator covers, using the new plant at Gary, Ind., which it has purchased from the Central Metallic Door Company. The new plant, it is stated, will give the company increased facilities and resulting economics which will result in a superior product.

Everhot Heater Co., Detroit, Mich., manufacturer of the Everhot automatic water heater, announces that ground was broken recently for the first of the new factory units which the company is building in Detroit. The new plant, it is expected, will be completed by November 1. This rapidly-growing company found it necessary to obtain larger quarters for the manufacture of its product, and the new plant, when completed, will have a capacity of 100,000 heaters per year. The company was organized a little over four years ago and it now has distribution in nearly every section of the United States. New quarters for the company's Detroit branch were opened September 1 at 6440 Case Avenue.

C. A. Dunham Co., Chicago, has acquired the business of the Young Pump Co., Michigan City, Ind., and will con-



The Turbo Atomizer

The Turbo Atomizer is the heart of Bayley Air Washing Systems. It does away with multiple orifice sprayers which are easily clogged and which produce a spray not altogether free from holes.

It operates with low current consumption and at very low water pressure, throwing an even, finely divided spray radially against the walls of the washing chamber.

Three Types are Built Around this Principle

Type "A" **For washing and humidifying (cleaning).** The Type "A" Washer is installed where cleaning is the primary consideration. It uses the water over and over, and removes 98% of foreign matter from the air. Humidity may be added as desired.

Type "B" **For washing and de-humidifying (cooling).** For cooling air, the cleaning being incidental, Type "B" Washer, consisting of tandem sprays, is installed, and is capable of bringing the temperature of the entering air practically to the water temperature.

Type "C" **For washing without humidifying (drying).** Where clean air for drying processes must be obtained without increasing its humidity, the Type "C" Washer is installed, using a special washing emulsion.

Bayley **Manufacturing Company**
742 Greenbush Street
MILWAUKEE

CENTRAL STATION STEAM CO.
2912 East Woodbridge St.
DETROIT, MICHIGAN

MANUFACTURERS OF
Cadillac Condensation Meters
Detroit Feed Water Meters

Packingless Expansion Joints and other special fittings for underground steam distribution mains.

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STANDARD DATA SHEETS

SOME SUBJECTS

B. T. U. Losses	Flow of Steam in Pipes
Ducts and Flues	One Pipe Steam Systems
Chimneys	Vacuum Heating Systems
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Pipe Covering	Gravity Water Heating

280 Sheets Covering 26 Important Subjects
Price 5 Cents per Sheet

Send for folder giving full list and special prices on sets and folder

HEATING AND VENTILATING MAGAZINE CO.
1123 Broadway, New York City

The only hot water regulator containing the Genuine Sylphon TRADE MARK Bellows is made by The Fulton Company Knoxville, Tenn.

No. 45-A Sylphon Damper Regulator for Hot Water Boilers and Tank Heaters.

Here is a cut-open view of the No. 45-A Sylphon Damper Regulator containing the genuine Sylphon Bellows for its expansion member. Every ounce of honor and ability we possess is put into the manufacture of Sylphon Heating Specialties. If there was any way to improve upon the design or manufacture of Sylphon Damper Regulators, we would do so. The best costs no more than imitations—so why not secure the best and fortify yourself against future trouble and complaint. Our guarantee is your constant safeguard.

Known to the Trade for the past 10 years

Every hot water job should be thermostatically controlled. Sylphon Damper Regulators will give uniform heating comfort, prevent generation of steam in the system, save fuel, save trips to basement to adjust draft dampers, and prevent scalds from over-heated faucet water. Specify Sylphon Damper Regulators on new work, and keep your eyes open to the many possibilities for sales on jobs already in service.

Ask for Bulletin WDR

THE FULTON COMPANY KNOXVILLE, TENN.

New York Chicago Detroit Boston Philadelphia *Representatives in all principal cities in U. S.*

European representatives: Crosby Valve & Engineering Co., Ltd., 41–42 Foley Street, London, W. I., England

Canadian representatives: Darling Bros., Ltd., 120 Prince Street, Montreal, Canada

tinue the manufacture of the Young Pump Company's products. This will materially strengthen the position of the C. A. Dunham Company by rounding out its line of vacuum and vapor heating appliances. All Young patents, it is stated, patent applications and contracts under which the Young products are being manufactured have likewise been purchased and assigned in their entirety.

Appointment of S. B. DeLong as Manager of Manufacturing for American Radiator Company

Announcement is made of the appointment of Stanley B. DeLong as general manager of manufacturing of the American Radiator Company, succeeding the late Riley L. Redpath. Mr. DeLong first entered the employ of the American Radiator Company at Steel Plant as a helper, later becoming a clerk in the office. In 1898, at the age of 21 years, he was made superintendent of Steel Plant. In 1903 he was transferred to Buffalo as assistant manager of Pierce Plant, under Manager A. A. Landon. Later, when Mr. Landon became general superintendent of plants, Mr. DeLong remained at Pierce Plant, and in February, 1906, was appointed its manager. He held this responsible position until May, 1913, when he was appointed assistant general manager of plants, with Mr. Landon again as his chief. On February 1, 1914, his title was changed to district manager of plants. After about five years the new title of director of radiator manufacture was given him, a position he has filled up to the time of his present appointment.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

DISTRICT MANAGERS WANTED, with heating and ventilating experience to handle complete line of blowers and unit heaters in larger cities. Address Box 91, care of Heating and Ventilating Magazine.

Dry Air Essential

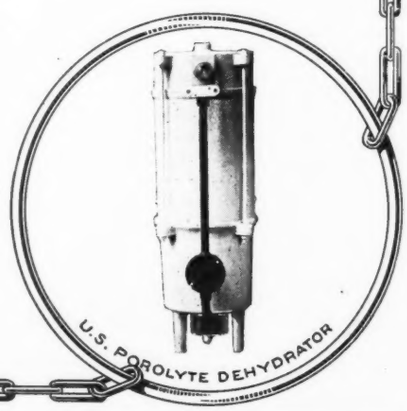
It is impossible to meter ozone electrically unless perfectly dry air is used.

Moisture in an ozone generator produces *Nitric Acid* at the *expense* of *ozone.*

The *production* of ozone varies *inversely* as the *moisture.*

The U. S. Ozone Meter *accurately* indicates the ozone produced, because—U. S. Porolyte Dehydrators serve *perfectly dry air* to U. S. Ozonizers.

We maintain our own Research Laboratories and Engineering Staff. Technical Publications on OZONE sent on request.



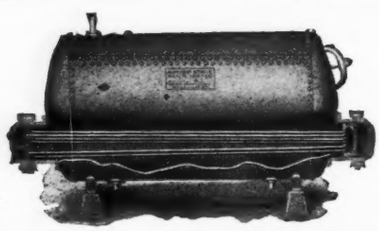
MONTGOMERY BROTHERS

Chicago San Francisco New York

General Sales Agents for

THE UNITED STATES OZONE COMPANY

Scottdale, Penna.



Alberger-Buffalo Storage Heaters have tubes the full length of tank which insures maximum heat transfer. Satisfaction guaranteed. Write for information on Alberger Multi Head Heaters and Howard Guided Expansion Joints.

ALBERGER HEATER COMPANY

HOWARD IRON WORKS

281-289 Chicago St. Buffalo, N. Y.

FOSTER ENGINEERING CO.

NEWARK, N. J.

PRESSURE REGULATORS FOR STEAM HEATING SYSTEMS— FOSTER "CLASS Q"

Absolutely reliable and accurate for any delivery pressure between atmosphere and 15 lbs. *maximum.*

The "standard" of many heating contractors, for over twenty-five years. Installed properly "Foster" guarantees results.